

PATKAI CHRISTIAN COLLEGE
(AUTONOMOUS)
NAAC REACCREDITATION: A GRADE
“A COLLEGE WITH POTENTIAL FOR EXCELLENCE”
(Affiliated to the Nagaland University)



12th ACADEMIC COUNCIL
10th MAY 2019

Choice Based Credit System
(Effective from Academic Year 2019-2020)



ANNEXURE IV

RECOMMENDED COMPOSITION OF THE ACADEMIC COUNCIL AND ITS FUNCTIONS IN AN AUTONOMOUS COLLEGE

I. Composition:

1. The principal (Chairman).
2. All the heads of department in the college.
3. Four teachers of the college representing different categories of teaching staff by rotation on the basis of seniority of service in the college.
4. Not less than four experts from outside the college representing such areas as Industry, Commerce, Law, Education, Medicine, Engineering etc., to be nominated by the Governing Body.
5. Three nominees of the university. 6. A faculty member nominated by the principal (member secretary).

II. Terms of Members:

The term of the nominated members shall be two years.

III. Meetings:

The principal shall convene a meeting of the Academic Council at least once a year.

IV. Functions:

Without prejudice to the generality of functions mentioned, the Academic Council will have powers to:

- (a) Scrutinise and approve the proposals with or without modification of the Boards of Studies with regard to courses of study, academic regulations, curricula, syllabi and modifications thereof, instructional and evaluation arrangements, methods, procedures relevant thereto etc., provided that where the Academic Council differs on any proposal, it will have the right to return the matter for reconsideration to the Board of Studies concerned or reject it, after giving reasons to do so.
- (b) Make regulations regarding the admission of students to different programmes of study in the college.
- (c) Make regulations for sports, extra-curricular activities, and proper maintenance and functioning of the playgrounds and hostels.
- (d) Recommend to the Governing Body proposals for institution of new programmes of study.
- (e) Recommend to the Governing Body institution of scholarships, studentships, fellowships, prizes and medals, and to frame regulations for the award of the same.
- (f) Advise the Governing Body on suggestions(s) pertaining to academic affairs made by it.
- (g) Perform such other functions as may be assigned by the Governing Body.

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MEMBERS OF THE ACADEMIC COUNCIL

| | | | |
|-----|------------------------|-------------------------|-----------|
| 1. | Mr. Hüsazü Epao | Principal | Chairman |
| 2. | Angel Sonari | Vice-Principal | Secretary |
| 3. | Mr. A.G. Samuel | Controller of Exams | Member |
| 4. | Dr. T. Pieru | Dean of Sciences | Member |
| 5. | Dr. R. K. Behera | Dean of Social Sciences | Member |
| 6. | Dr. Vivee Peseye | Dean of Music | Member |
| 7. | Mr. Amay Angami | Dean of Students | Member |
| 8. | Prof. Lungsang Zeliang | NU Representative | Member |
| 9. | Dr. Sedevi Angami | Expert (Medical) | Member |
| 10. | Mr. Jonathan Kikon | HOD, Economics | Member |
| 11. | Mr. Visazo Chase | HOD, History | Member |
| 12. | Mr. Wetshete Thopi | HOD, Pol.Sc | Member |
| 13. | Mrs. Akangsenla | HOD, English | Member |
| 14. | Mrs. Ase Z Pongshi | HOD, Education | Member |
| 15. | Dr. Wojanbeni | HOD, Philosophy | Member |
| 16. | Mr. Anal Chandra Sarma | HOD, Physics | Member |
| 17. | Mrs. Avono Savino | HOD, Botany | Member |
| 18. | Mr. Binod Chetry | HOD, Mathematics | Member |
| 19. | Dr. Sanjeeb Dey Badiya | HOD, Zoology | Member |
| 20. | Mr. Oinam U-Wang | HOD, Chemistry | Member |
| 21. | Dr. Th. Devala Devi | HOD, Geology | Member |
| 22. | Ms. Hüsatülü | HOD, Commerce | Member |
| 23. | Mr. Milan Singha | HOD, Computer Sc. | Member |
| 24. | Dr. Dakter Esse | HOD, Mass Comm. | Member |

ECONOMICS HONOURS

| Semester | Core Course | Ability Enhancement Courses | Skill Enhancement Courses | Discipline Specific Elective Courses | Generic Elective Courses |
|--------------------------|--|-----------------------------|----------------------------------|--------------------------------------|---------------------------------|
| First | Introductory Microeconomics (6) | Environmental Studies (2) | | | Introductory Microeconomics (6) |
| | Mathematical Methods for Economics: I (6) | | | | |
| Second | Introductory Macroeconomics (6) | English (2) | | | Introductory Macroeconomics (6) |
| | History of Economics Thoughts (6) | | | | |
| Third | Intermediate Microeconomics: I (6) | | Entrepreneurship Development (2) | | Indian Economy: I (6) |
| | Intermediate Macroeconomics: I (6) | | | | |
| | Statistical Methods for Economics (6) | | | | |
| Fourth | Intermediate Microeconomics: II (6) | | Data Analysis (2) | | Indian Economy: II (6) |
| | Intermediate Macroeconomics: II (6) | | | | |
| | Introductory Econometrics (6) | | | | |
| Fifth | Indian Economy: I (6) | | | Money and Financial Markets (6) | |
| | Economics of Growth and Development - I (6) | | | Public Economics (6) | |
| Sixth | Indian Economy: II (6) | | | International Economics (6) | |
| | Economics of Growth and Development - II (6) | | | Environmental Economics (6) | |
| No. of Courses (Credits) | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |

ECONOMICS: CORE COURSE / GENERIC ELECTIVE COURSE**Semester I****Course Code: a) Core - ECO 111 b) Generic - ECO 311****Course Title: INTRODUCTORY MICROECONOMICS**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description:

This course is designed to expose the students to the basic principles of microeconomic theory. The emphasis will be on thinking like an economist and the course will illustrate how microeconomic concepts can be applied to analyze real life situations.

Course Outline**1. Exploring the subject matter of economics**

Scope and methodology of economics; the economic problem; scarcity and choice; the question of what to produce, how to produce and how to distribute output; science of economics; role of price mechanism; production possibility curve; economic systems.

2. Supply and demand: How markets work, markets and welfare

Markets and competition; determinants of individual demand/supply; demand/supply schedule and curve; market versus individual demand/supply; shifts in the demand/supply curves; consumer surplus; producer surplus.

3. The Households

The consumption decision- budget constraint, consumption and income/price changes, demand for all other goods and price changes; description of preferences (representing preferences with indifference curves); properties of indifference curves; consumer's optimum choice; income and substitution effects.

4. The firm and perfect market structure

Behaviour of profit maximizing firms and the production process; short run costs and output decisions; cost and output in the long run

5. Imperfect market structure

Monopoly and anti-trust policy; government policies towards competition; imperfect competition

Readings:

1. Karl E Case and Ray C. Fair, Principles of Economics, Pearson Education Inc., 8th Edition, 2007.
2. N. Gregory Mankiw, Economics: Principles and Applications, Indian edition by South Western, a part of Cengage Learning, Cengage Learning India Private Limited, 4th edition, 2007.
3. Ahuja, H.L (1990) Advance Economic Theory, Chand and Co. New Delhi.
4. Koutsoyiannis, A. (1990), Modern Microeconomics, Macmillan

Semester I

Course Code: ECO 112

Course Title: MATHEMATICAL METHODS FOR ECONOMICS

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description:

The objective of this course is to transmit the body of basic mathematics that enables the study of economic theory at the undergraduate level, specifically the courses on microeconomics, macroeconomics, statistics and econometrics.

Course Outline**1. Preliminaries**

Variables, Range, Image, Equations, System of Equations and Identities; Functions: Constant, Polynomial, Rational, Irrational, Algebraic, Non-Algebraic and Homogeneous Functions; Relation and Function; Set and Set Theories; Venn Diagram and its application in economics; Practical Problems.

2. Matrix And Determinants

Meaning, types of Matrices, Rows and Columns, Trace, Order, Inverse, Addition, Subtraction and Multiplication of Matrices; Determinants and their properties; Solving simultaneous equations using matrix inversion and Cramer's Rule

3. Difference Equations

Meaning, rules of differentiation, Convexity and continuity of a function, partial differentiation, maximization and minimization, higher order derivatives; Elasticity of demand; Theory of Cost and Revenue.

4. Integration of Functions

Meaning, rules of integration, methods of integration: substitution and integration by parts; Definite and Indefinite integrals; Consumer's Surplus and Producer's Surplus.

5. Linear Programming and Game Theory

Concepts and formulation, Solution of linear programming through graphs; Input-Output analysis; Game theory; Pure and mixed strategies, saddle-point solution, Prisoner's dilemma.

Readings:

1. K. Sydsaeter and p. Hammond, Mathematics for Economic Analysis, Pearson Educational Asia: Delhi, 2002.
2. Chiang, A.C. (2000), Fundamental Methods of Mathematical Economics, McGraw Hill, New Delhi.
3. Taro Yamane, Mathematics for Economist, Prentice- Hall of India.
4. Koutsoyiannis, A (1990), Modern Microeconomics, Macmillan.
5. Baruah, Srinath (2000), Mathematical Economics, Macmillan.

Semester II

Course Code: a) Core - ECO 121 b) Generic - ECO 321
 Course Title: INTRODUCTORY MACROECONOMICS

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description

This course aims to introduce the students to the basic concepts of Macroeconomics. Macroeconomics deals with the aggregate economy. This course discusses the preliminary concepts associated with the determination and measurement of aggregate macroeconomic variable like savings, investment, GDP, money, inflation, and output and employment.

Course Outline**1. Introduction to Macroeconomics and National Income Accounting**

Nature and scope of macroeconomics; National Income: Concepts of NI, measurement of NI, importance of NI, National Income and Economic welfare; Circular flow of economic activity in a two sector economy.

2. Money and Banking

Functions of money; Quantity theories of money: Cash transaction approach, Cash balances approach; Determinants of money supply; Commercial banking: Functions, Credit creation and its limitations.

3. Inflation

Inflation: types (concepts), causes, effects, social cost of inflation, hyperinflation and control of inflation; Deflation and reflation (Concepts).

4. Classical Macroeconomics

Says law of market; Classical theory of employment; Classical theory of interest; Classical dichotomy and neutrality; Pigou's effect; Keynes criticism of Classical theory.

5. Keynesian and Post-Keynesian Macro Analysis

Aggregate demand and aggregate supply; Principle of effective demand; General equilibrium of monetary and real sector- ISLM curves.

Readings

1. Dornbusch, Fischer and Startz, *Macroeconomics*, McGraw Hill, 11th edition, 2010.
2. N. Gregory Mankiw, *Macroeconomics*, Worth Publishers, 7th edition, 2010.
3. Olivier Blanchard, *Macroeconomics*, Pearson Education, Inc., 5th edition, 2009.
4. Richard T. Froyen, *Macroeconomics*, Pearson Education Asia, 2nd edition, 2005.
5. Andrew B. Abel and Ben S. Bernanke, *Macroeconomics*, Pearson Education, Inc., 7th edition, 2011.
6. Errol D'Souza, *Macroeconomics*, Pearson Education, 2009.
7. Paul R. Krugman, Maurice Obstfeld and Marc Melitz, *International Economics*, Pearson Education Asia, 9th edition, 2012.

Semester II

Course Code: ECO 122
Course Title : HISTORY OF ECONOMIC THOUGHTS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description

This course aims to introduce the students to the evolution of Economic theories. Students will learn about the theoretical foundations of economic theories. The paper deals with the thinkers of ancient, mediaeval and the modern era as close as Amartya sen.

Course Outline**1. Early Period**

History of Economic Thought and Economic History; Methodological Approaches to Economic Thought; Importance of history of Economic Thought. Economic thought of Plato, Aristotle and St. Thomas Aquinas.

2. Mercantilism and Physiocracy

Factors responsible for the rise of mercantilism and their main ideas; Contribution of Hume and Cantillon; Factors responsible for the rise of Physiocracy and their main ideas; Contribution of Quesnay and Turgot.

3. Classical Period

Features of Classical Economics; Adam Smith – Theory of value and economic growth; David Ricardo – Distribution and economic growth; Malthus – Theory of population and economic growth; Karl Marx- Dynamics of social change, theory of value, surplus value and crisis of capitalism.

4. New Classical

Wicksell – Theory of Capital; Marshall – Value and Distribution; Wieser – Theory of Alternative cost and Imputation; Bohm-Bawerk : Theory of value, capital and interest; Veblen – Theory of Leisure Class; Keynes – Main ideas.

5. Indian Economic Thought

Kautilya, Dadabhai Naoroji, Ranade, Gokhale, Gandhi and Amartya Sen.

Readings:

1. Blaug, M(1997), Economic Theory in Retrospect: A History of thought from Adam Smith to J.M.Keynes, (5th Edition) Cambridge University Press Cambridge.
2. Blackhouse, R (1985), A History of Modern Economic Analysis, Basil Blackwell Oxford.
3. Grey, A and A.E. Thomson (1980), The Development of Economic Doctrine (2nd Edition), Longman Group, London.
4. Paul, R.R. (1979), History of Economic Thought, Kalyani Publishers, Ludhiana, New Delhi.
5. Schumpeter, J.A. (1954), History of Economic Analysis, Oxford University Press, Oxford.

Semester III

Course Code: ECO 131

Course Title: INTERMEDIATE MICROECONOMICS-I

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description:

The course is designed to provide a sound training in microeconomic theory to formally analyze the behavior of individual agents. Since students are already familiar with the quantitative techniques in the previous semesters, mathematical tools are used to facilitate the understanding of the basic concepts.

Course Outline**1. Preferences:**

Consumer preferences, Indifference Curves: Perfect Substitutes, Perfect Complements, Bads, Neutrals, Satiation, Well- Behaved Preferences, The marginal rate of substitution.

2. Utility and Choice:

Utility Function, Cardinal and Ordinal Utility, Indifference curves from utility; Budget Constraint; Optimal Choice.

3. Demand:

Demand Function, normal and inferior goods, ordinary and Giffen goods, substitutes and complements, the inverse demand function, Slutsky equation, Intertemporal choice, Revealed preference.

4. Production:

Technology: Technology constraints, properties of technology, the technical rate of substitution; Isoquants; Production with one and more variable inputs; Returns to Scale.

5. Costs:

Short-run and long-run costs, cost curves in the short-run and in the long-run. Traditional and Modern theory of costs.

Readings:

1. Hal R. Varian, Intermediate Microeconomics, A modern Approach, W.W. Norton and company/ Affiliated East-West Press (India), 8th edition, 2010.
2. C. Snyder and W. Nicholson, Fundamentals of Microeconomics, Cengage Learning (India), 2010.
3. B. Douglas Bernheim and Michael D. Whinston, Microeconomics, Tata McGraw Hill (India), 2009.

Semester III

Course Code: ECO 132

Course Title: INTERMEDIATE MACROECONOMICS – I

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description

This course introduces the students to formal modeling of a macro-economy in terms of analytical tools. It discusses various alternative theories of output and employment determination in a closed economy in the short run as well as long run, and the role of policy in this context. It also introduces the students to various theoretical issues related to an open economy.

Course Outline**1. Aggregate Demand and Aggregate Supply Curves**

Aggregate demand and aggregate supply (short-run and long-run AS curve); AD and AS in the Keynesian model; AD and AS in the Classical model; Difference between the Classicists and Keynes on AD and AS.

2. Keynesian Macroeconomics

Keynesian theory of Income, Output and Employment; Consumption function: APC, MPC, Psychological law of consumption, Factors determining consumption.

3. Post-Keynesian Theories of Consumption Function

Kuznets's consumption puzzle; Relative income hypothesis; Life-cycle hypothesis; Permanent income hypothesis.

4. Investment Function

Investment: Business fixed investment; residential investment; inventory investment; Autonomous and Induced investment; Determinants of investment – MEC and MEI; The concept of Multiplier.

5. Inflation - Unemployment and Expectations

Phillips curve; Adaptive and Rational expectations; Policy ineffectiveness debate.

Readings

1. Dornbusch, Fischer and Startz, *Macroeconomics*, McMraw Hill, 11th edition, 2010.
2. N. Gregory Mankiw, *Macroeconomics*, Worth Publishers, 7th edition, 2010.
3. Olivier Blanchard, *Macroeconomics*, Pearson Education, Inc., 5th edition, 2009.
4. Steven M. Sheffrin, *Rational Expectations*, Cambridge University Press, 2nd edition, 1996.
5. Andrew B. Abel and Ben s. Bernanke, *Macroeconomics*, Pearson Education, Inc., 7th edition, 2011.
6. Errol D'Souza, *Macroeconomics*, Pearson Education, 2009.
7. Paul R. Krugman, Maurice Obstfeld and Marc Melitz, *International Economics*, Pearson education Asia, 9th edition, 2012.

Semester III

Course Code: ECO 133

Course Title: STATISTICAL METHODS FOR ECONOMICS

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description

This is a course on statistical methods for economics. It begins with some basic concepts and terminology that are fundamental to statistical analysis and inference. This is followed by discussion on techniques used to collect survey data. Measures on central tendency and dispersion are studied followed by correlation and regression. Basic concept on time series and Index Number is discussed. It then develops the notion of probability, followed by probability distribution of discrete and continuous random variables and of joint distribution.

Course Outline**1. Introduction to Statistics:**

Meaning, Scope, Importance and Limitation of Statistics; Basic concepts: Frequency and Cumulative frequency distribution; Collection of data: Primary and Secondary data; Questionnaire and Schedule; Presentation of data: Diagrams and Graphs – General rules for constructing a diagram – Types of diagrams – Types of graphs. Sampling: Census Vs Sample Method, Size of Sample, Sampling and non-sampling errors.

2. Central Tendency and Dispersion:

Measures of Central tendency: Mean, Median, Mode, Geometric and Harmonic Means. Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of Variation, Skewness and Kurtosis.

3. Correlation and Regression:

Correlation Analysis: Meaning and types of correlation; Methods of studying correlation: Scatter diagram method, Graphic method, Karl Pearson's co-efficient of correlation and Rank correlation. Regression Analysis: Definition, Regression equation: Y on X and X on Y.

4. Time Series and Index Numbers:

Concepts, Components and Uses; Measuring Linear Trend: Graphic method, method of semi-averages, method of moving averages and method of least squares.

Index Numbers: Concepts, Uses, Problems in the construction and limitation of index number. Methods of constructing Index Numbers. Weighted (Lapeyers, Paasches and Fisher's Ideal Index) Family budget method.

5. Probability :

Concepts, Event: Independent, Dependent, Mutually exclusive, Equally likely and favorable cases: Theorems (addition and subtraction).

Readings:

1. John E. Freund, Mathematical Statistics, Printice Hall, 1992.
2. Richard J. Larsen and Morris L. Marx, An Introduction to Mathematical Statistics and its Applications, Prentice Hall, 2011.
3. Gupta, S.C and V.K. Kapoor (1999), Fundamentals of Applied Statistics, S. Chand & Sons, New Delhi.
4. William G. Cochran, Sampling Techniques, John Wiley, 2007.

Semester IV

Course Code: ECO 141
 Course Title: INTERMEDIATE MICROECONOMICS - II

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description:

This course is a sequel to Intermediate Microeconomics I. The emphasis will be on giving conceptual clarity to students coupled with the use of mathematical tools and reasoning. It covers general equilibrium and welfare, imperfect markets and topics under information economics.

Course Outline:**1. General Equilibrium:**

Partial Equilibrium and General Equilibrium; Pure exchange economy; Equilibrium and efficiency under pure exchange and production.

2. Welfare:

Welfare Economics: Pareto criterion of measuring social welfare, the Kaldor-Hicks criterion, Skitovsky's Paradox, Social welfare function, welfare maximization.

3. Market Structure:

Monopoly; Pricing with market power; Price Discrimination; peak-load pricing; two-part tariff; Monopolistic Competition and Oligopoly.

4. Game Theory:

Game Theory: the pay-off matrix of a game; Nash Equilibrium, Prisoner's Dilemma, the Neumann - Morgenstern Game Theory.

5. Market Failure:

Externalities; Public Goods and markets with Asymmetric Information.

Readings:

Hal. R. Varian, Intermediate Microeconomics, A modern Approach, W.W Norton and company/ Affiliated East-West Press (India), 8th edition, 2010.

C. Snyder and W. Nicholson, Fundamentals of Microeconomics, Cengage Learning (India), 2010.

B. Douglas Bernheim and Michael D Whinston, Microeconomics, Tata McGraw Hill (India), 2009.

Semester IV

Course Code: ECO 142
 Course Title: INTERMEDIATE MACROECONOMICS - II

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description

This course is a sequel to Intermediate Macroeconomics 1.

Course Outline**1. Theories of Demand for money**

Demand for money: Keynes's theory of demand for money; Tobin's Portfolio approach to demand for money; Friedman's theory of demand for money.

2. Business Cycles

Types, phases; Theories of business cycles: Hawtrey's monetary theory; Keynes theory of business cycle; The Cobweb theory of business cycles; Control of business cycles.

3. Fiscal and Monetary Policies

Active or passive; Monetary policy objectives and targets; Rules versus discretion; Fiscal and monetary policy in the IS-LM context (closed economy).

4. Post – Keynesian Schools of Macroeconomic Thought

Supply-Side Economics; New-Keynesians Macroeconomics: Sticky Nominal Wages; Mankiw Sticky Prices Model; Sticky Real Wages; Coordination Failure.

5. Open Economy Models

Short run open economy models; Mundell-Fleming model; Exchange rate determination; Purchasing power parity; Dornbusch's overshooting model; Monetary approach to balance of payments.

Readings

1. Dornbusch, Fischer and Startz, Macroeconomics, McGraw Hill, 11th edition, 2010.
2. N. Gregory Mankiw, Macroeconomics, Worth Publishers, 7th edition, 2010.
3. Olivier Blanchard, Macroeconomics, Pearson Education, Inc., 5th edition, 2009.
4. Charles I. Jones, Introduction to Economic Growth, W.W. Norton & Company, 2nd edition, 2002.
5. Andrew B. Abel and Ben S. Bernanke, Macroeconomics, Pearson Education, Inc., 7th edition, 2011.
6. Errol D'Souza, Macroeconomics, Pearson Education, 2009.
7. Robert J. Gordon, Macroeconomics, Prentice-Hall India Limited, 2011.

Semester IV

Course Code: ECO 143
Course Title: INTRODUCTORY ECONOMETRICS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description:

This course provides a comprehensive introduction to the basic econometric concepts and techniques. It covers statistical concepts of hypothesis testing, estimation and diagnostic testing of simple regression models. The course also covers the consequences of and tests for misspecification of regression models.

Course Outline**1. Introduction to Econometrics**

Origin, definition, Objectives, scope and limitations of econometrics; Methodology of econometrics; Classical, Bayesian, Theoretical and Applied econometrics; Forecasting and Prediction: Stochastic and non-stochastic variables, dummy and proxy variables; Time series, Cross section, Pooled Data and Panel Data; Accuracy of Data.

2. Statistical Concepts

Mathematical expectation: meaning, properties and application. Statistical probability distribution: Binomial, Poisson and Normal Distributions- Definition, properties, Application and Fitting.

3. Regression Analysis

Regression: meaning and modern interpretation, 2-variable population regression function and sample regression function, 2-variable population and sample regression line; Linearity in variable, Linearity in Parameter, Stochastic disturbance term.

4. Basic Methods and Models of Econometrics

Estimation of model by method of Ordinary Least Squares; Assumptions and Interpretation of the CLRM; Classical Normal Linear Regression Model (CNLRM); Properties of Estimators; goodness of fit (R^2); Standard error; Gauss- Markov Theorem

5. Analysis and Problems of Econometric models

Hypothesis Testing; Power of a test; Problems of Heteroscedasticity, Autocorrelation and Multicollinearity

Readings:

1. Gujarati, D. (1995), Basic Econometrics, McGraw Hill, New Delhi.
2. Christopher Dougherty, Introduction to Econometrics, Oxford University Press, 3rd edition, Indian edition, 2007.
3. Kmenta, J, Elements of Econometrics, Indian Reprint, Khosla Publishing House, 2nd edition 2008.

Semester V

Course Code: a) Core - ECO 151 b) Generic - ECO 331
 Course Title: INDIAN ECONOMY - I

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description

Using appropriate analytical frameworks, this course reviews major trends in economic indicators and policy debates in India in the post-Independence period, with particular emphasis on paradigm shifts and turning points. Given the rapid changes taking place in India, the reading list will have to be updated annually.

Course Outline**1. Economic Development Strategy since Independence**

Mixed Economic Framework; Key and strategic role of PSUs; Economic Crisis of 1990; Major Economic Reforms implemented since 1991; Structural Adjustment Programmes – Globalisation, Liberalisation and Privatisation.

2. Demographic Features

Population: Size, Structure (sex and age), Characteristics, Rural-urban migrations, Occupational distribution, Problems of over population, Population policy, Gender inequality, Women empowerment.

3. Growth and Distribution

Trends and policies in poverty; inequality and unemployment.

4. Economic Planning

Meaning and rationale of Planning; Basic strategies, objectives and achievements of Planning; Strategies of latest Five Year Plan, Inclusive development – NITI Aayog.

5. External Sectors

Role of foreign trade; Trends in exports and imports; Composition and Direction of India's foreign trade; BOP crisis; Export promotion measures and the new trade policies; Foreign capital – FDI and MNCs.

Readings:

1. Jean Dreze and Amartya Sen, 2013. An uncertain Glory: India and its Contradictions, Princeton University Press.
2. Pulapre Balakrishnan, 2007, The Recovery of India: Economic Growth in the Nehru Era, Economic and Political Weekly, November.
3. Himanshu, 2010, Towards New Poverty Lines for India, Economic and Political Weekly, January.
4. Jean Dreze and Angus Deaton, 2009, Food and Nutrition in India: Facts and Interpretations, Economic and Political Weekly, February.
5. Himanshu. 2011, - Employment Trends in India: A Re-examination, Economic and Political Weekly, September.
6. T. Dyson, 2008, - India's Demographic Transition and its Consequences for Development in Uma Kapila, editor, Indian Economy Since Independence, 19th edition, Academic Foundation.
7. Agarwal, A.N. Indian Economy, Vikas Publishers, New Delhi.

Semester V

Course Code: ECO 152

Course Title: ECONOMICS OF GROWTH AND DEVELOPMENT - I

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description

This is the first part of a two-part course on economics of growth and development. The course begins with the fundamental concepts on growth and development. It then proceeds to aggregate models of growth and development. The course ends by studying on Investment and planning.

Course outline**1. Fundamental concepts:**

Meaning of economic development and underdevelopment; Distinction between economic growth and economic development; Measurement of economics development – GNP,PCI,PQLI,HDI and multidimensional poverty index ; Factors affecting growth; Importance of agriculture , industry and infrastructure in economics development.

2. Theories of Economic Development:

Classical theories of development- Adam Smith, Ricardo, Malthus, Karl Marx and Schumpeter.

3. Theories of Economic Growth

Harrod and Domar, Solow, Joan Robinson, Kaldor and Endogenous growth theory.

4. Partial theories of Growth and development:

Circular causation, Rostow's stages of Growth, Big push theory, Balance versus Unbalanced growth.

5. Investment and Planning

Meaning and need for Planning; types of planning; Investment Criterion; Choice of technique in LDCs; Project Evaluation(Cost- Benefit analysis).

Readings

1. Agarwal, R.C and Lakshmi Narain Agarwal, Economics of Development and Planning(Theory and Practice).
2. Debraj Ray, Development Economics, Oxford University Press,2009.
3. Amartya Sen, Development as Freedom, OUP,2000.
4. Taneja and Myer (2007), Economic Development and Planning, Vishal Publication Co. Jhalandhar.
5. A.P. Thirlwall, Growth and Development, Palgrave, Macmillan.
6. Y. Hayami, Development Economics, Oxford University Press, India.

Semester VI

Course Code: Course Code: a) Core - ECO 161
b) Generic - ECO 341
Course Title: INDIAN ECONOMY-II

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description

This course examines sector-specific policies and their impact in shaping trends in key economic indicators in India. It highlights major policy debates and evaluates the Indian empirical evidence. The course ends by studying the Nagaland Economy. Given the rapid changes in the country, the reading list will have to be updated annually.

Course Outline**1. Macroeconomic Policies and their Impact**

Fiscal Policy; Monetary policy; Investment policy; Labour regulation.

2. Policies and Performance in Agriculture

Growth; Productivity; Agrarian structure; Green Revolution; Rural credit; Agriculture marketing.

3. Policies and Performance in Industry

Growth; Productivity; Role of MSMEs in Indian economy, Problems and remedies; Industrial Policy Resolution of 1956 and 1991; Sources of industrial finance; Role of public sector enterprises.

4. Services Sector and Infrastructural development

Role and Performance of Services Sector in India; Growth of infrastructure during the Planning Period; Recent Strategy adopted by the Government for infrastructure development; Smart Cities Mission.

5. Economy of Nagaland

Natural resources; Population; agricultural system; Industrial development; Infrastructure and Structural changes in Nagaland Economy.

Readings:

1. Shankar Acharya, 2010, - Macroeconomic Performance and Policies 2000-08, in Shankar Acharya and Rakesh Mohan, editors, India's Economy: Performances and Challenges: Development and Participation, Oxford University Press.
2. Rakesh Mohan, 2010, - India's Financial sector and Monetary Policy Reform, in Shankar Acharya and Rakesh Mohan, editors, India's Economy: Performances and Challenges: Development and Participation, Oxford University Press.
3. Pulapre Balakrishnan, Ramesh Golait and Pankaj Kumar, 2008, - Agricultural Growth in India Since 1991, RBI DEAP Study no. 27.
4. Kunal Sen, 2010, - Trade, Foreign Direct Investment and Industrial Transformation in India, in Premachandra Athukorala, editor, The Rise of Asia, Routledge.
5. Statistical Handbook, Economic Survey (Various Issues), Government of India and Nagaland.
6. NUTA, Economic Development in Nagaland: Prospects and Constraints.

Semester VI

Course Code: ECO 162

Course Title: ECONOMICS OF GROWTH AND DEVELOPMENT - II

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description

This is the second module of the economics of growth and development. It begins with basic demographic concepts and their evolution during the process of development. The structure of markets and contracts is linked to the particular problems of enforcement experienced in poor countries. The course ends with reflection on the role of globalization and increased international dependence on the process of development.

Course outline**1. Demography and Development:**

Demographic concepts; birth and death rates, age structure, fertility and mortality; demographic transition during the process of development; connections between income, mortality, fertility choices and human accumulation; migration.

2. Land, Labour and Credit markets:

The distribution of land ownership; land reform and its effects on productivity; contractual relationships between tenants and landlords; land acquisition; nutrition and labour productivity; informational problems and credit contracts; microfinance; inter-linkages between rural factor markets.

3. Environment and Sustainable Development:

Defining sustainability for renewable resources; a brief history of environment change; common-pool resources; environment externalities and state regulation of the environment; economic activity and climate change.

4. Globalization:

Globalization in historical perspective; the economies and policies of multilateral agreements; financial instability in a globalized world.

5. Human Capital: Education and Health in economic development.

Central roles of Education and Health; Education and health as a joint investment- the human capital approach; Education and Development; Social versus Private benefits and costs of education; Migration and brain drain; Health and Development; Policies for health and income generation

Readings:

1. Debraj Ray, Development Economics, Oxford University Press, 2009.
2. Partha Dasgupta, Economics, A Very Short Introduction, Oxford University Press, 2007.
3. Abhijit Banerjee, Roland Benabou and Dilip Mookerjee, Understanding Poverty, Oxford University Press, 2006.
4. Thomas Schelling, Micromotives and Macrobehavior, W. W. Norton, 1978.
5. Raghuram Rajan, Fault Lines: How Hidden Fractures Still Threaten the World Economy, 2010.
6. Dani Rodrik, The Globalization Paradox: Why Global Markets, States and Democracy Can't Coexist, Oxford University Press, 2011.
7. Michael D. Bordo, Alan M. Taylor and Jeffrey G. Williamson (ed), Globalization in Historical Perspective, University of Chicago Press, 2003.

Semester V

Course Code: ECO 251
 Course Title: MONEY AND FINANCIAL MARKETS

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description

This course exposes students to the theory and functioning of the monetary and financial sectors of the economy. It highlights the organisation, structure and role of financial markets and institutions. It also discusses interest rates, monetary management and instruments of monetary control. Financial and banking sector reforms and monetary policy with special reference to India are also covered.

Course Outline**1. Money**

Concept , functions, measurement; Theories of money supply determination.

2. Financial Institutions, Markets, Instruments and Financial Innovations

- Role of financial markets and institutions; problem of asymmetric information – adverse selection and moral hazard; financial crises.
- Money and capital markets: Features of developed and undeveloped money and capital markets with special references to India; organisation, structure and reforms in India; role of financial derivatives and other innovations.

3. Interest Rates

Determinaton; sources of interest rate differentials; theories of term structure of interest rates; interest rates in India.

4. Banking System

- Balance sheet and portfolio management.
- Indian banking system: Changing role and structure; banking sector reforms.

5. Central Banking and Monetary Policy

Functions, balance sheet; goals, targets, indicators and instruments of monetary control; monetary management in an open economy ; current monetary policy of India.

Readings

- F.S. Mishkin and S.G. Eakins, *Financial Markets and Institutions*, Pearson Education, 6th edition, 2009.
- F.J. Fabozzi, F. Modigliani, F. J. Jones, M. G. Ferri, *Foundations of Financial Markets and Institutions*, Pearson Education, 3rd edition, 2009.
- M.R.Baye and D.W. Jansen, *Money, Banking and Financial Markets*, AITBS,1996.
- Rakesh Mohan, *Growth with Financial Stability-Central Banking in an Emerging Market*, Oxford University Press, 2011.
- L.M. Bhole and J.Mahakud, *Financial Institutions and Markets*, Tata McGraw Hill, 5th edition, 2011.
- M.Y. Khan, *Indian Financial System*, Tata McGraw Hill, 7th edition, 2011.
- N. Jadhav, *Monetary Policy, Financial Stability and Central Banking in India*, Macmillan, 2006.
- R.B.I. – *Report of the Working Group: Money Supply Analytics and Methodology of Compilation*, 1998.
- R.B.I. Bulletin, Annual Report and Report on Currency and Finance (Latest).

Semester V**Course Code: ECO 252****Course Title: PUBLIC ECONOMICS**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description:

Public economics is the study of government policy from the point of view of economic efficiency and equity. The paper deals with the nature of government intervention and its implication for allocation, distribution and stabilization. This study also involves a formal analysis of government taxation and expenditures.

Course Outline:**1. Fiscal Functions: An Overview.**

Fiscal Functions; An overview of the Allocation Function, the Distribution Function and the Stabilization Function.

2. Public Goods:

Definition, models of efficient allocation, pure and impure public goods, problem and solution of free - riding.

3. Externalities:

The problem of externalities and its solutions, taxes versus regulations, property rights, the Coase Theorem.

4. Taxation:

Taxes: its economic effects; dead weight loss and distortions, efficiency and equity considerations, tax incidence, Optimal Taxation.

5. Indian Public Finance:

Tax System: Structure and reforms, Budget, deficits and Public Debt, Fiscal Federalism in India.

Readings:

1. J. Hindricks, G. Myles: Intermediate Public Economics, MIT Press, 2006.
2. H. Rosen, T. Gayer: Public Finance, McGraw Hill/Irwin, 2009.
3. M.M Sury, Government Budgeting in India, 1990.
4. State Finances: A study of budget reserves, RBI (latest).
5. Shankar Acharya, 2005, Thirty years of tax reforms in India, EPW, May 14-20.

Semester VI

Course Code: ECO 261
Course Title: INTERNATIONAL ECONOMICS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Description

This course develops a systematic exposition of models that try to explain the composition, direction and consequences of international trade, and the determinants and effects of trade policy. It then builds on the models of open economy focusing on national policies as well as international monetary systems. It concludes with an analytical account of the causes and consequences of the rapid expansion of international financial flows in recent years. Although the course is based on abstract theoretical models, students will also be exposed to real-world examples and case studies.

Course Outline**1. Introduction**

What is international economics about? Inter-Regional and International trade; Need for a separate theory of international trade; features and importance of international trade.

2. Theories of International Trade.

Trade theories: The Ricardian, Specific factors, and Heckscher –Ohlin models; New trade theories: The Kravis theory of availability; Posner's technological gap theory; Vernon's product cycle theory; firms in the global economy – outsourcing and multinational enterprises.

3. Trade and commercial policy

Free trade versus Protection; tariffs: meaning and types; Import quotas: meaning and types; Dumping: meaning and types; Exchange controls: meaning and methods of exchange controls; Political economy of trade policy.

4. Balance of Payments and International Macroeconomic Policy

Meaning; Structure of BOPs; Balance of trade and balance of payments; Causes for disequilibrium in BOPs; Methods to correct deficit in BOPs. Fixed versus flexible exchange rates; International monetary system; Financial globalization.

5. International Economic Institutions and Trading Blocks

International Monetary Fund (IMF); World Bank; WTO; Asian Development Bank (ADB); ASEAN (Look East Policy).

Readings:

1. Paul Krugman, Maurice Obstfeld, and Marc Melitz, *International Economics: Theory and Policy*, Addison-Wesley Pearson Education Indian Edition, 9th edition, 2012.
2. Dominick Salvatore, *International Economics: Trade and Finance*, John Wiley International Student Edition, 10th edition, 2011.

Semester VI

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: ECO 262

Course Title: ENVIRONMENTAL ECONOMICS

Course Description:

This course focuses on economic causes of environmental problems. In particular, economic principles are applied to environmental questions and their management through various economic institutions, incentives and policies.

Course Outline:

1. Introduction:

What is environmental economics? Review of microeconomics, Welfare economics and Externalities.

2. The design and implementation of Environmental Policy:

Overview; Pigouvian taxes and effluent fees; tradable permits; choice between taxes and quotas under uncertainty; implementation of environmental policy.

3. International Environmental Problems:

Trans-boundary environmental problems; economics of climate changes; trade and environment.

4. Measuring benefits of Environmental Improvements:

Non-market values and measurement methods; risk assessment and perception.

5. Sustainable Development:

Concepts and Measurement.

Readings:

1. Charles Kolstad, Intermediate Environmental Economics, OUP, 2nd edition, 2010.
2. Robert N. Stavins, Economics of the Environment, W.W Norton, 5th edition, 2005.
3. Maureen L. Cropper and Wallace E. Oates, 1992, Environmental Economics: A Survey, Journal of Economic Literature, Vol. 30:675-740.

SKILL ENHANCEMENT COURSE

Semester III

Course Code: ECO 531

Course Title: ENTREPRENEURSHIP DEVELOPMENT

| | | | |
|----------------|-------|-------|-------|
| Credit : 2 | L -2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Course Description

To enable students to understand the basic concepts of entrepreneurship and preparing a business plan to start a small industry.

Unit 1: ENTREPRENEURSHIP

Introduction- Meaning & Definition of Entrepreneurship, Entrepreneur & Enterprise. Function of Entrepreneur, Factors influencing Entrepreneurship, Pros & Cons of being an Entrepreneur, Qualities of an Entrepreneur, Types of Entrepreneur.

Unit 2: SMALL SCALE INDUSTRIES

Meaning & Definition, meaning and importance of Tiny industries, Cottage industries. Role played by SSI in the development of Indian economy. Problems faced by SSI's and the steps taken to solve the problems. Policies governing SSI's.

Unit 3: FORMATION OF SMALL SCALE INDUSTRY.

Steps involved in the formation of a small business Venture: location, clearance and permit required, formalities, licensing and registration procedure. Assessment of the market for the proposed project- Financial, Technical, Market and Social feasibility study.

SKILL DEVELOPMENT

Preparation of a project report to start a SSI Unit.

Preparing a letter to the concerned authority- seeking license for the proposed SS Unit.

Format of a business plan.

A report on the survey of SSI units in the region where college is located.

Success stories of Entrepreneurs in the region.

BOOKS FOR REFERENCE

1. Vasant Desai, Management of Small Scale Industry, HPH.
2. Mark Dollinger, Entrepreneurship- Strategies and Resources
3. Dr. Venkataramana; Entrepreneurial Development

Semester IV

Course Code: ECO 541
Course Title: DATA ANALYSIS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L -2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Course Description;

This course introduces the student to collection and presentation of data. It also discusses how data can be summarized and analysed for drawing statistical inferences. The students will be introduced to important data sources that are available and will also be trained in the use of free statistical software to analyse data.

Course Outline:**Sources of data:**

Population census versus sample surveys. Random sampling.

Classification, tabulation of data and diagrammatic and graphic presentation:

Formation of discrete and continuous frequency distribution, tabulation of data, different types of diagrams and graphs.

Univariate frequency distribution:

Measures of central tendency: mean, median and mode. Measures of dispersion, skewness and kurtosis.

Readings:

P.H. Kamel and M. Polasek(1978), Applied statistics for Economists, 4th edition, Putman.

M.R. Spiegel(2003), Theory and problems of probability and statistics(Schaum Series).

EDUCATION HONOURS

| Semester | Core Course | Ability Enhancement Course | Skill Enhancement Course | Discipline Specific Elective | Generic Elective Course |
|-----------------------|--|----------------------------|--|--|---|
| First | Philosophical Foundation of Education (6) | Environmental Studies ((2) | | | Philosophical Foundation of Education (6) |
| | Trends of Modern Education in India (6) | | | | |
| Second | Sociological Foundation of Education (6) | English (2) | | | Sociological Foundation of Education (6) |
| | Alternative Schooling (6) | | | | |
| Third | Educational Psychology (6) | | Curriculum Development (2) | | Educational Psychology (6) |
| | Educational Measurement and Evaluation (6) | | | | |
| | Statistics in Education (6) | | | | |
| Fourth | Educational Management (6) | | Early Childhood Care and Education (2) | | Educational Management (6) |
| | Guidance and Counseling (6) | | | | |
| | Educational Technology & Pedagogy (6) | | | | |
| Fifth | Development of Education in India (6) | | | Indian Educational Thoughts and Practices (6) | |
| | Comparative Education (6) | | | Special Education - I (6) | |
| Sixth | Education in Modern India (6) | | | Western Educational Thoughts and Practices (6) | |
| | Value and Peace Education (6) | | | Special Education-I I (6) | |
| No. of Courses | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |

EDUCATION: CORE COURSE / GENERIC ELECTIVE COURSE**Semester I**

Course Code: a) Core - EDN 111 b) Generic - EDN 311
Course Title: Philosophical foundation of Education

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objectives:

To develop understanding of the meaning, aims and functions of education
 To develop understanding of the role of philosophy in education
 To develop understanding of some schools of philosophy

Course contents:**Unit I:**

Education and Philosophy- concept, scope and its relationship.
 Types of education - formal, non-Formal and Informal.

Unit II:

Individual aims of education- Need and importance
 Character development
 Successful living
 Self- realisation

Unit III:

Social aims of education- Need and importance
 Vocational development
 Development of democratic outlook
 Synthesis between individual and social aim of education

Unit IV:

Freedom and discipline in education-
 meaning, types and importance in educational and social life.

Unit V:

School of thoughts-
 Idealism, Naturalism and Pragmatism- aims, curriculum, methods of teaching and its contribution.

Suggested Readings:

1. V.R. Taneja – Educational Thoughts and Practice.
2. A.S Thakur_ Philosophical Foundation of Education.
3. Bhagirathi Sahu _ The New Educational Philosophy
4. Sutharamu A S _ Philosophy of education
5. Rusk RR _ Philosophical Base of Education
6. Chatterjee S and Dutta D.M _ An introduction to Indian Philosophy

Semester I

Course Code: EDN 112
Course Title: Trends of Modern Education in India

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objectives:

To develop understanding of significant trends in contemporary India
 To develop understanding of various institution and their roles in the implementation of policies and programmes.

Course contents:**Unit I:**

Pre-School Education: Aims and objectives.
 Importance of Early Childhood Care and Education (ECCE).
 NECCEP 2013

Unit II:

Elementary Education: Aims and objectives
 Universalisation of elementary education and its
 Problems of elementary education.
 SSA

Unit III:

Secondary Education: Aims and Objectives
 Vocationalisation of Secondary Education
 Problems of Secondary education. RMSA

Unit IV:

Higher Education: Aims and Objectives
 Types of Universities,
 Problems of Higher Education, RUSA
 Role of UGC and NAAC

Unit V:

Teacher Education- Aims and objectives
 Problems of teacher education
 Role of DIET, SCERT, NCERT and NCTE

Suggested Readings:

1. R.S.Pandy _ Development of Indian System of education 2008
2. Challenges of Education: A Policy Perspective. 1985 Ministry of education.
3. Wallia J S _ Education in Emerging Indian Society
4. Saxena N R and Chaturvedi 2008 _ Education in Emerging Indian Society

Semester II

Course Code: a) Core - EDN 121 b) Generic - EDN 321
 Course Title: Sociological foundation of education

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objectives:

To develop understanding of the role of sociology in education
 To develop understanding of the role of education in the process of social interaction for a change towards better human relationship
 To acquaint with social problems relating to education

Course contents:**Unit I:**

Sociology - meaning, nature and importance
 Sociology of education- meaning and scope

Unit II:

Social stratification and mobility-
 Social change- meaning, factors of social change, education as a reflection of social change.

Unit III:

Social control- meaning, types and role of education
 Contemporary social issues-Unemployment, youth unrest

Unit IV:

Concept of social process and social interaction
 Kinds of social interactions-co-operation, competition, conflicts, accommodation and assimilation

Unit V:

Culture- concept and characteristics, role of education in promotion and transmission of Cultural heritage.
 Cultural practices of North-East India with special reference to Nagaland- festivals, rituals and Informal institutions.

Suggested reading:

1. Yogendra K Sharma _ Sociological Philosophy of Education
2. Saxena N R _ Philosophical and Sociological Foundation of Education
3. Rao C N _ Introduction to Principles of Sociology
4. Brown F J _ Educational Philosophy
5. Mathur S.C _ A sociological Approach of Indian Education
6. Hurlambos M. _ Sociology Oxford University Press, New Delhi.

Semester II

Course Code: EDN 122
Course Title: Alternative schooling

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objectives:

To develop understanding of alternative modes of education
 To acquaint with the role, initiative and programmes in spreading education
 To focus attention on certain major national and social issues and the role of education in relation to them.

Course contents:**Unit I:**

Alternative schooling- meaning and importance
 Schemes of alternative schooling in India
 Adult education- Meaning and concept
 NAEP, NLM

Unit II:

Lifelong education –meaning and importance
 Informal exposure
 Open school
 Open University

Unit III:

Work education- Aims and objectives
 Needs and importance of work skill education in the school curriculum
 Professional ethics- meaning and scope

Unit IV:

Women's education- Needs and importance
 Problems of girl's education
 Measures for promoting women's education
 Women's empowerment

Unit V:

Population education- Importance of population education to maintain the quality of life
 Factors responsible for population growth
 Population explosion and education
 Sex education- Aims, objectives and scope

Suggested Reading;

1. R.P Pathak _ History Development and Contemporary Problems of Education
2. Shashi Khanna _ Relevance of Distance Education.
3. Bhatia (2008) Development of Educational System.
4. Singh R P _ Indian Education: In depth studies.

Semester III

Course Code: a) Core - EDN 131 b) Generic - EDN 331
 Course Title: Educational Psychology

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objectives:

To enable the students to understand the meaning and scope of educational psychology
 To enable them to understand the dimensions of growth and development
 To enable them to understand different aspects of personality and means of developing an integrated personality.

Course contents:**Unit I:**

Psychology- Concept of psychology, relationship between psychology and education
 Application of educational psychology in teaching-learning process

Unit II:

Stages of growth and development with special reference to adolescence- physical, social, emotional and intellectual
 Fundamentals of Piagetian developmental psychology

Unit III:

Learning and motivation- Types of learning (Gagne)
 Factors of learning
 Maslow's theory of motivation
 Role of motivation in learning

Unit IV:

Personality- Determinant of personality development
 Theories of personality (Jung and Sigmund Freud)

Unit V:

Intelligence _ meaning and characteristic
 Spearman's Two Factor Theory
 Factors of intelligence – Heredity and environment
 Emotional Intelligence – meaning, characteristic and importance

Suggested Reading:

1. Chauhan S S _ Advanced Educational Psychology
2. Aggarwal J C _ Essentials of Educational Psychology
3. Mangal S K _ Advanced Educational Psychology
4. Woolfolk A E _ Educational Psychology 2011

Semester III

Course Code: EDN 132

Course Title: Educational Measurement And Evaluation

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objectives:-

To develop an understanding of the concept of measurement and evaluation in the field of education.

To acquaint with different types of measuring instruments and their uses.

To acquaint with the principles of test construction – both educational and psychological.

Course content:**Unit 1:**

Educational Measurement and Evaluation- concept and objectives

Relationship between measurement and evaluation.

Types of evaluation- Formative and summative.

Unit 11:

Measuring instruments and their classification, types of scales in educational measurement.

Tools- scholastic and co-scholastic.

Characteristics of a good measuring instrument – validity, reliability and objectivity.

Unit III:

Educational and Instructional objectives

Blooms Taxonomy- Cognitive, Affective and Psychomotor domain

Unit 1V:

General principles of test construction –

Types of test and their differences - teacher-made and standardized tests.

Unit V:

Psychological test- Measurement of interest, attitude and intelligence

(Interest Pattern by RP Singh)

(Rao's School Attitude Inventory)

(Jalota's Test of Intelligence)

Suggested Readings:

1. Asthana, Bipin. & Agarwal, R.N. – Measurement and Evaluation in Psychology and Education. Vinod Pustak Mandir, Dr.Rangeya Ragava Marg, Agra - 2
2. Sharma, R.A. – Advanced Educational Psychology, Eagle Book International
3. Das, G. – Psychological Testing and Statistics. Forward Publishing Company. Educational Publishers' 4787/23, Ansari Road, Daryaganj, New Delhi.

Semester III

Course Code: EDN 133
Course Title: Statistics in Education

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objectives:

1. To develop the ability to use various statistical measures in analysis and interpretation of education data.
2. To develop skills in analyzing different measures.
3. To enable the students to read professional literatures.

Course contents:**Unit I:**

Statistics- meaning, need and importance
 Educational statistics– Meaning, nature, scope and its uses.

Unit II:

Organization of data:
 Grouped and ungrouped data.
 Graphical representation of data- frequency polygon, histogram, cumulative frequency graph, ogive, pie diagram and their uses.

Unit III:

The Normal Curve –
 Normal Probability Curve – concept, properties and its applications
 Measures of divergence from normality – skewness and kurtosis.

Unit IV:

Measures of central tendency- mean, median and mode.
 Measures of variability – range, average deviation, standard deviation, quartile deviation and their uses.

Unit V:

Co-relational statistics: Examining relationships- Meaning and types of correlations. Computation of co-efficient of correlation; rank difference and product moment method. Interpretation of co-efficient of correlation.

Suggested Readings:

1. Cronback, L.J. - Essentials of psychological testing. New York, Harper and brothers.
2. Garrett, H.E. - Statistics in Psychology and Education. Eastern Book House, Shantipur, Guwahati
3. Freeman, Frank S. – Psychological Testing. Oxford & IBH Publishing Co. PVT. LTD, New Delhi, Mumbai, Kolkata
4. Asthana, Bipin., Agarwal, R.N. – Measurement and Evaluation in Psychology and Education. Vinod Pustak Mandir, Dr. Rangeya Ragava Marg, Agra - 2
5. Sharma, R.A. – Advanced Educational Psychology, Eagle Book International
6. Das, G. – Psychological Testing and Statistics. Forward Publishing Company. Educational Publishers' 4787/23, Ansari Road, Daryaganj, New Delhi.

Semester IV

Course Code: a) Core - EDN 141 b) Generic - EDN 341

Course Title: Educational Management

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objectives:

1. To develop knowledge and understanding of the meaning, scope, process and types of Management.
2. To develop ability to identify the roles of participating members (individual collective) and to plan various institutionalized managerial activities
3. To develop the ability of making objective decision in educational management.

Course contents:**Unit I:**

Management-meaning and components

Educational management- Meaning, characteristics and scope.

Types of educational management: centralized and decentralized

Unit II

Leadership- Meaning and characteristic of a good leader

Leadership style-autocratic and democratic, creative and laissez-faire

Advantages and disadvantages

Unit III:

Institutional planning and management-meaning and nature

School plant, time table, curricular and co-curricular programmes and evaluation of student achievement.

Unit IV:**School management-**

Meaning and types of resources; human, material and financial resources;
role of supervision and Inspection

Unit V:

Educational planning-

Meaning and nature, principles and steps of educational planning.

Types of educational planning.

Suggested readings:

1. Educational administration, supervision, planning and financing. Bhatnagar R.P and Aggarwal
2. Management in education- Choudary and N.R
3. Educational management supervision school management- Prof. Jagannath Mohanty
4. Educational technology, management and evaluation- Rashmi Agrawal
5. Essentials of educational technology and management- J.C Aggarwal

Semester IV

Course Code: EDN 142
Course Title: Guidance And Counselling

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objectives:

1. To help in understanding the meaning and importance of guidance and counselling.
2. To develop the ability to interpret various records for assessing the students strengths and weaknesses.
3. To develop the ability to identify gifted children who need enrichment and exceptional children who need special care in a positive way through.

Course contents:**Unit I:**

Concepts of guidance- meaning, nature and principle of guidance
 Meaning and need of personal guidance

Unit II:

Educational guidance- purpose and principles
 Background information for educational guidance- pupil abilities, aptitude, interest, and Attitude.

Unit III:

Vocational guidance- meaning, purpose and function
 Vocational guidance at the secondary stage

Unit IV:

Concept of counselling- meaning, nature and techniques of counselling
 Characteristics of a good counsellor
 Transactional analysis (TA)

Unit V:

Career counselling- meaning and importance of career counselling with college students
 Occupational information services, career conference and simulated interview.

Suggested readings-

1. Educational, vocational guidance and counselling. Principles, techniques and programmes - Rashmi Agrawal, Shipra publication, New Delhi- 110092
2. Principles of guidance and counselling- Sitaram Jaiswal
3. Guidance and counselling- a manual, B.G Barki Murkhopadha
4. Educational, vocational guidance and counselling- J.C Aggarwal
5. Guidance and counselling service- Downing L.M

Semester IV

Course Code: EDN 143
Course Title: Educational Technology and Pedagogy

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objectives:

1. To enable the students to understand the nature and scope of educational technology
2. To expose the students to the basic development in educational technology
3. To initiate the to the field of pedagogy and to develop a positive attitude towards teaching profession.

Course contents-**Unit I:**

Educational technology- meaning, nature and types- hardware, software, system approach

Unit II:

Communication process- concept, nature
 Types of classroom communication, barriers of communication
 Mass media approach in education

Unit III:

Information and Communication Technology (ICT), Computer Assisted Instruction (CAI),
 And Personalized System of Instruction (PSI).

Unit IV:

Pedagogy- principles of teaching
 General maxims of teaching and marks of a good teacher

Unit V:

Innovation in teaching strategies- programme learning, team teaching, simulation in
 teaching, micro and macro teaching

Suggested Reading:

1. Sharma R A – Advanced Educational Technology
2. Mohanty J _ Educational Technology
3. Aggarwal J C _ Essentials of aeducational Technology and Management
4. Rashmi Aggarwal _ Educational Technology Management and Evaluation

Semester V

Course Code: EDN 151
Course Title: Development of Education in India

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objectives:-

1. To help students understand the development of education in India from Historical perspectives.
2. To understand the salient features of education in ancient, medieval and British India.
3. To have an adequate knowledge of the recommendations of various Commissions and committees of Indian education during British India.

Course contents:-**Unit 1:**

Ancient India- Vedic Education - aims, curriculum and organisation of education.
 Buddhist Education – aims, curriculum and organisation.
 The four eternal truths.

Unit 11:

Medieval India- Islamic Education- its salient features, objectives and curriculum.
 State patronage of educational endeavour.
 Other educational institutions of medieval India.

Unit 111:

Education in British India
 A. Phase 1
 Educational activities of missionaries towards Indian education.
 Significance of Charter Act of 1813
 Macaulay's Minute (1835)

Unit 1V:

B. Phase 2
 Wood's Despatch (1854)
 Hunter's Commission (1882)
 Gokhale's Movement for free and compulsory education

Unit V:

C. Phase 3
 Calcutta University Commission (1917)
 Hartog Committee (1929)
 Sargent Report (1944)

Suggested Readings;

1. Chaube S P _ History and Development of Modern Indian Education
2. Aggarwal J C _ Landmark in History of Modern Indian Education
3. Rawat P L. _ History of Education in India
4. Lal and Sinha _ Development and Problems of Indian Education

Semester V

Course Code: EDN 152
Course Title: Comparative Education

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Objectives:

1. To understand the needs and importance of comparative education.
2. Making a comparative analysis of educational system in different countries.
3. Understanding the various issues and problems of education in the third world countries.

Course content-**Unit I:**

Comparative education- meaning, characteristics and objectives
 Approaches in comparative education

Unit II:

Primary education- China, USA (objectives, curriculum, and methods of teaching)

Unit III:

Secondary education- China, USA (objectives, curriculum, methods of teaching and vocational education)

Unit IV:

Higher education- China, USA (objectives, curriculum and methods of teaching)
 Comparison between China and USA system of education.

Unit V:

Problems prevailing in third world countries- poverty, illiteracy and role of education in solving the problems

Suggested readings:

1. Sharma, R.A. - Comparative education: Educational system and problems of the world. R. Lall book depot – 2009
2. Gezi, K.L. Educational Comparative and International Perspective. New York, Halt Rehehart and Winston. 1971
3. Comparative education- A Comparative Study of Educational System. DVS publisher and Distributors, Guwahati – 2004
4. Vashish, S.R., Teacher Education in the Third world countries. Anmol Publication. New Delhi. 1992
5. UNESCO World Problem in Education: A brief Analytical Survey, Paris. UNESCO. 1975
6. UNESCO Growth and Change: Perspectives of Education in Asia. New Delhi Starling Publishers.
7. Rao, V.K. and Reddy. R.S. – Comparative Education. New Delhi. Commonwealth Publishers. 1997

Semester VI

Course Code: EDN 161
Course Title: Education in Modern India

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objectives:

1. To acquaint with the knowledge of the recommendations of various commissions and national policies
2. To help students understand problems and issues of education in modern India

Course contents-**Unit I:**

Aims and objectives and its impact;
 University Education Commission (1948-1949)
 Secondary Education Commission (1952-1953)
 Kothari Education Commission (1964-1966)

Unit II:

National Policy in Education (NPE) 1986-
 National system of education
 Education for equality
 Reorganisation of education

Unit III:

National Knowledge Commission (NKC) 2005-
 Its focus areas
 Recommendations on higher education
 Recommendations on vocational education
 National Curricular framework (2005)

Unit IV:

RTE 2009
 Constitutional provision in relation to education-salient features and critical analysis

Unit V:

Problems and issues of education in modern India with special reference to Nagaland
 Rural-Urban Disparity
 Gender disparity
 Absenteeism
 Quality issues for competence and commitment
 Role of community in solving educational problems

Suggested Readings:

1. Chaube S P _ History and Development of Modern Indian Education
2. Aggarwal J C _ Landmark in History of Modern Indian Education
3. Rawat P L. _ History of Education in India
4. Lal and Sinha _ Development and Problems of Indian Education

Semester VI

Course Code: EDN 162
Course Title : Value and Peace Education

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objectives:

1. To acquaint the students with values of life.
2. To promote the Naga cultural values
3. Developing peaceful co-existence

Course Contents:**Unit I:**

Value Education
 Meaning, aims and types- intrinsic and extrinsic.
 Value nurturing climate

Unit II:

Development of human values
 Moral, social and aesthetics
 Role of home, school and community

Unit III:

Education for National Integration and International Understanding.

Unit IV:

Naga Cultural Values – Hospitality, honesty, hardworking, Courageous and respect for elders.

Unit V:

Peace Education –Meaning and importance.
 Factors hindering peace in the society (class, caste and tribalism)
 Conflict resolution- meaning and need

Suggested Readings:

1. Resource Book for Value education: Institute of Value Education. 39, Institute Area – Janakpuri, New Delhi. By Mani Jacob and J.Dinakarlal, Reny Jacob
2. Joshi, Dhananjay.- Value Education in Global Perspective. Lotus press, 4263/3, Ansari Rd. Darya Ganj, New Delhi – 2
3. Nekha, K.N.- The Nagas: Culture and Education.
4. Nekha, K.N.- Tracing Specific Folk Values of Sumi tribe of Nagaland Contributing to Existential Harmony. 2005

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSEC)**Semester V**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: EDN 251

Course Title: Indian Educational Thoughts and Practices

Objectives:

1. To narrate the concept of education in the context of Indian heritage.
2. To examine the contributions of Indian philosophers towards education.
3. To make a comparative analysis of eastern thought with modern education.

Course Contents:**Unit I:**

Vedic Philosophy

Unit II:

Indian Schools of Philosophy (Sankhya and Vedanta and their Educational implications)

Unit III:

Rabindranath Tagore – His philosophy and contribution (Shantiniketan)

Unit IV:

Mahatma Gandhi- His philosophy and contribution (Basic Education)

Unit V:

Swami Vivekananda – His philosophy and contribution

Suggested Reading:-

1. Great Educational Thinkers; Western and Indian
By B C Rai Dhanpat Rai and Sons Publications
2. Educational Thinkers

Semester V

Course Code: EDN 252
Course Title: Special Education I

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Objectives:

1. To enable the students to identify the children with special needs.
2. To enable the students to understand the problems and needs of gifted and creative children.
3. To enable the students to understand various educational and guidance programmes for the gifted and creative children.

Course contents:**Unit I:**

Historical Development of Special education

Contributors of special education-Itard Jean Mearc Gaspard, Charles-Michel de l'Epee, Ann Sullivan , Louis Braille and Edouard Seguin

Unit II:

Exceptional Children- meaning characteristic and classification

Principles and needs of special education

Unit III:

Concept of giftedness- identification of gifted children and their needs

Educational principles for gifted children

Role of the teachers.

Unit IV:

Problems of the gifted children

Guidance for gifted children

Role of parents and counsellors

Unit V:

Creativity- concept, characteristics of creativity

Factors fostering creativity

Relationship between intelligence and creativity.

Suggested Reading:

1. Mahesh Bhargava – Introduction to Exceptional Children: Their nature and educational provision.
2. Chintamani Kar _ Exceptional Children: Their psychology and education
3. Chauhan SS _ Education of Exceptional Children
4. Gupta P K _ Education for Creativity

Semester VI

Course Code: EDN 261

Course Title : Western Educational Thoughts and Practices

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objectives:

1. To narrate the concept of education in the context of western thoughts.
2. To examine the contributions of Western philosophers towards education.
3. To make a comparative analysis of Western thought with modern education.

Course Contents:**Unit I:**

Ancient Period – Greek and Roman system of education

Unit II:

Education in Europe during the Renaissance Period

Unit III:

Marxism

Unit IV:

Existentialism – Soren Kierkegard

Unit V:

Realism

Semester VI

Course Code: EDN 262
Course Title: Special Educational II

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objectives:

1. To enable the students to understand the characteristics of physically and mentally challenged children
2. To identify the symptoms and problems of delinquents and deprived children.
3. Learning how the different educational provisions can help such children.

Course contents:**Unit I:**

Backward children- meaning and characteristic
 Types of backwardness and causes

Unit II:

Physically handicapped children-meaning and characteristics
 Characteristics of orthopedically impaired, visually impaired, aurally impaired and speech impaired children
 Their causes and education

Unit III:

Mentally retarded children- meaning and general classification
 Classification on the basis of I.Q and causes
 Education of educable mentally retarded children and the role of teachers.
 Education of trainable mentally retarded children and role of the parents.

Unit IV:

Juvenile Delinquency: meaning, symptoms of delinquency, causes and remedial measures
 Socially deprived children- meaning and characteristics
 Causes, problems and educational provisions.

Unit V:

Constitutional rights and provisions for disabled children
 National policy on disabled children.

Suggested Reading:

1. Mahesh Bhargava – Introduction to Exceptional Children: Their nature and educational provision.
2. Chintamani Kar _ Exceptional Children: Their psychology and education
3. Chauhan SS _ Education of Exceptional Children
4. Gupta P K _ Education for Creativity
5. Farwel M _ Special Education Needs
6. Porter L _ Educating Young Children with Special Needs.

SKILL ENHANCEMENT COURSE (SEC)**Semester III**

Course Code: EDN 531
Course Title: Curriculum Development

| | | | |
|-----------------------|--------------|--------------|-------------|
| Credit : 2 | L -2 | P - 0 | T -0 |
| Marks (CIA:ES) | 20:30 | - | - |

Objectives:

1. Define and explain the concept of curriculum
2. Suggest bases of curriculum such as philosophical, psychological and sociological
3. Identify major issues and trends in curriculum

Course Contents:**Unit I:**

Concept of Curriculum
 Meaning, nature and scope of curriculum
 Factors influencing curriculum development

Unit II:**Types of curriculum:**

Child-centred curriculum, subject-centred curriculum, experience centred curriculum

Bases of curriculum:

Philosophical, psychological and sociological.

Unit III:**Curriculum Construction:**

Principles and procedures for curriculum construction.
 Importance of co-curricular activities.

Suggested Readings:

1. Sharma, R.A.- Curriculum Development and Instruction. R.Lall Book Depot
2. Beane, Conrad, EP Jr and Samuel J.A.Jr. – Curriculum Planning and Development. Allyn and Bacon, Boston. 1986
3. Brady, L.- Curriculum Development. Prentice Hall. 1995
4. Orstein, A.C. and Hunkins, E. – Curriculum Foundations, Principles and Issues. Allyn and Bacon. Boston. 1998
5. Curriculum Development – Theory and practice. Harcourt Brance. New York. 1962

Semester IV

Course Code: EDN 541

Course Title: Early Childhood Care and Education

| | | | |
|----------------|-------|-------|------|
| Credit : 2 | L -2 | P - 0 | T -0 |
| Marks (CIA:ES) | 20:30 | - | - |

Objectives-

1. To understand the importance of Early Childhood Care and Education
2. To study the contributions of educationists and philosophers
3. Study the provisions and policies for Early Childhood

Course Contents:**Unit I:**

Different aspects of development at the infancy stage

Physical/Motor

Mental/Cognitive

Social/Emotional

Language

Unit II:

Contributions of Froebel and Montessori to pre- school education

Unit III

Government programme and schemes-ICDS

Suggested Readings:

1. Aggarwal, J.C. – Methods and Materials of Nursery Education. Doaba House, 1990.
2. ECCE (1, 11 and 111) Nasin Siddiqui, Suman Bhatia and Suptika Biswas. Doaba House, 1688, NAI SARAK, Delhi - 110006
3. Wort, C.Sue – Early Childhood Curriculum. Guwahati, Nividita Book Distributors, 2002.
4. Riley, J. – Learning in the Early Years, A guide for teachers. New Delhi, Saga Publications, 2003
5. Day Barbara – Early Childhood education: Organising Learning Activities. New York, Mc Millan, 1983.
6. Child Development and Personality – Harper International Edition. Harper and Row Publishers, New York
7. Child Development Elizabeth B. Hurlock and Tata McGraw – Hill Publishing Company Ltd, New Delhi
8. Grewal, J.S. – Early Childhood Education- Foundation and Practice. National Psychological Corporation. Agra-U.P. India

ENGLISH HONOURS

| Semester | CORE COURSE | Ability Enhancement Compulsory Course | Skill Enhancement Course | Discipline Specific Elective | Generic Elective |
|--------------------------|---|---------------------------------------|-------------------------------|--|---|
| I | History and Forms of English Literature (6) | Environmental Studies (2) | | | Academic Writing & Composition (6) |
| | History of English Language and Phonetics (6) | | | | |
| II | Indian Writing in English (6) | English Communication (2) | | | Media & Communication Skills (6) |
| | British Poetry & Drama: 14 th -17 th Centuries (6) | | | | |
| III | American Literature (6) | | English Language Teaching (2) | | Poetry, Short Stories & One Act Plays (6) |
| | Popular Literature (6) | | | | |
| | British Poetry & Drama: 17 th & 18 th Centuries (6) | | | | |
| IV | British Literature: 18 th Century (6) | | Business Communication (2) | | Drama and Fiction (6) |
| | British Romantic Literature (6) | | | | |
| | British Literature: 19 th Century (6) | | | | |
| V | Women's Writing (6) | | | Literature of the Indian Diaspora (6) | |
| | British Literature: The Early 20 th Century (6) | | | Literary Criticism (6) | |
| VI | Modern European Drama (6) | | | Literary Theory(6) | |
| | Post Colonial Literature (6) | | | Science Fiction & Detective Literature (6) | |
| No. of Courses (Credits) | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |

CORE COURSE**Semester I**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: ENG 111**Course Title: History and Forms of English Literature****Unit – I:**

Elizabethan Age with special reference to the following major authors: Edmund Spenser and Henry Howard, Christopher Marlowe, William Shakespeare, Thomas Wyatt

Unit –II:

Age of Dryden and Pope with special reference to the following major authors: John Dryden and Alexander Pope

Unit- III:

The Romantic Movement with special reference to the following major authors: William Wordsworth, S.T. Coleridge, John Keats and P.B. Shelley

Unit –IV:

Victorian Age with special reference to the following major authors: Lord Tennyson, Robert Browning, Charles Dickens and Thomas Hardy,

Unit –V:

Modern Age with special reference to the following major authors: G.M. Hopkins, G.B. Shaw and T.S. Eliot.

Suggested Topics and Background Prose Readings for Class Presentation and Assignments:

1. Poetry: Lyric, Sonnet, Ode, Elegy, Ballad, Epic, Mock-Epic
2. Drama: Tragedy, Comedy, Tragicomedy, One-Act Play
3. Fiction: Plot, Character, Narrative Techniques, Short Stories
4. Literary Terms: Blank Verse, Dramatic Monologue, Comedy of Manners, Stream of Consciousness, Symbolism

Recommended Readings:

1. Goodman, W.R. *A History of English Literature*. Deoba House
2. Albert, E. *A History of English Literature*. OUP
3. Diaches, David. *A Critical History of English Literature*
4. Legouis and Cazamain. *A History of English Literature*
5. Compton-Rickett. *A History of English Literature*. New Dellhi, UBSP
6. Abrams, M. H. *A Glossary of Literary Terms*. Prism India
7. Lemon, L.T. *A Glossary for the Study of English*. New Delhi, OUP
8. Gibaldi, Joseph. *MLA Handbook for Writers of Research Papers*. Sixth Edition, 2004
9. Satish Kumar: *Ages, Movements and Literary Forms*, Narain's Publications, Agra.
10. Sanders, Andrew: *The Short Oxford History of English Literature*. OUP
11. Sanders, Andrew: *The Short Oxford History of English Literature*. OUP

Semester I

Course Code: ENG 112

Course Title: History of English Language and Phonetics

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit –I: Old, Middle and Modern English

Unit –II: Influences: Latin, Scandinavian, French and Indian Elements

Unit –III: Word-Making and Semantics

Unit –IV: Phonetics: Organs of Speech, Vowel and Consonant Sounds of English

Unit –V: English Phonetic Transcription

Recommended Readings:

1. Jespersen. *Growth and Structure of English Language*
2. Daniel Jones. *An Outline of English Phonetics*
3. A.C. Gimson. *An introduction to the Pronunciation of English*
4. T. Balasubramanian. *A Textbook of English Phonetics for Indian Students*
5. Kansakar, T.R. *A Course in English Phonetics*. Orient Blackswan
6. K.C Kurian. *History of English Language*
7. Albert C. Baugh: *History of English Language*
8. Thomas Cable: *The Cambridge History of the English Language*, A Companion to Baugh and Cable's History of the English Language. CUP..

Semester II

Course Code: ENG 121
Course Title: Indian Writing in English

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit –I:

R.K. Narayan: *The Vendor of Sweets*

Unit –II:

Anita Desai: *Cry, The Peacock*

Unit –III:

H.L.V. Derozio ‘Freedom to the Slave’ and ‘The Orphan Girl’
 Kamala Das: ‘An Introduction’ and ‘Punishment In Kindergarten’

Unit –IV:

Nissim Ezekiel: ‘Enterprise’ and ‘The Night of the Scorpion’
 Nini Lungalung: ‘Greetings, Pain’ and ‘Mirror’

Unit –V:

Temsula Ao: ‘The Last Song’
 Salman Rushdie: ‘The Free Radio’

Suggested Topics and Background Prose Readings for Class Presentations and Assignments

1. Indian English
2. Indian English Literature and its Readership
3. Themes and Contexts of the Indian English Novel
4. The Aesthetics of Indian English Poetry
5. Modernism in Indian English Literature

Recommended Readings

1. Raja Rao, Foreword to *Kanthapura* (New Delhi: OUP, 1989) pp.v–vi.
2. Salman Rushdie, ‘Commonwealth Literature does not exist’, in *Imaginary Homelands* (London: GrantaBooks, 1991) pp.61–70.
3. Meenakshi Mukherjee, ‘Divided by a Common Language’, in *The Perishable Empire* (New Delhi: OUP, 2000) pp.187–203.
4. Bruce King, ‘Introduction’, in *Modern Indian Poetry in English* (New Delhi: OUP, 2nd edn, 2005) pp.1–10.
5. Arvind Mehrotra, *History of Indian Literature*
6. K.B. Veio Pou, *Literary Cultures of India’s North-East: Naga Writers in English*. HPH

Semester II

Course Code: ENG 122
Course Title: British Poetry and Drama: 14th to 17th Centuries

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit –I:

Geoffrey Chaucer: *The Wife of Bath's Tale*
 John Donne: 'The Sunne Rising'
 'Batter My Heart'

Unit-II:

Edmund Spenser: Selections From *Amoretti*:
 Sonnet LXVII 'Like as a huntsman...'
 Sonnet LVII 'Sweet warrior...'
 Sonnet LXXV 'One day I wrote her...'

Unit –III:

Christopher Marlowe: *Doctor Faustus*

Unit –IV:

Ben Jonson: *The Alchemist*

Unit –V:

William Shakespeare: *Twelfth Night*

Suggested Topics and Background Prose Readings for Class Presentations And Assignments.

Renaissance, Humanism
 The Stage, Court and City, Religious and Political Thought
 Ideas of Love and Marriage
 The Writer in Society

Recommended Readings

1. Pico Della Mirandola, excerpts from the *Oration on the Dignity of Man*, in *The Portable Renaissance Reader*, ed. James Bruce Ross and Mary Martin McLaughlin (New York: Penguin Books, 1953) pp. 476–9.
2. John Calvin, 'Predestination and Free Will', in *The Portable Renaissance Reader*, ed. James Bruce Ross and Mary Martin McLaughlin (New York: Penguin Books, 1953) pp. 704–11.
3. Baldassare Castiglione, 'Longing for Beauty' and 'Invocation of Love', in Book 4 of *The Courtier*, 'Love and Beauty', tr. George Bull (Harmondsworth: Penguin, rpt. 1983) pp. 324–8, 330–5.
4. Philip Sidney, *An Apology for Poetry*, ed. Forrest G. Robinson (Indianapolis: Bobbs Merrill, 1970) pp. 13–18.

Semester III

Course Code: ENG 131
Course Title: American Literature

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

Tennessee Williams: *The Glass Menagerie*

Unit – II:

Toni Morrison: *Beloved*

Unit – III:

Edgar A. Poe: ‘The Purloined Letter’

F. Scott Fitzgerald: ‘The Crack-up’

Unit – IV:

Anne Bradstreet: ‘The Prologue’

Sherman Alexie: ‘Evolution’

Unit –V:

Walt Whitman: ‘O Captain, My Captain’

‘On the Beach at Night’

Robert Frost : ‘Mending Wall’

Suggested Topics and Background Prose Readings for Class Presentations and Assignments.

The American Dream

Social Realism and the American Novel

Folklore and the American Novel

Black Women’s Writings

Questions of Form in American Poetry

Recommended Readings

1. Hector St John Crevecoeur, ‘What is an American’, (Letter III) in *Letters from an American Farmer* (Harmondsworth: Penguin, 1982) pp. 66–105.
2. Frederick Douglass, *A Narrative of the life of Frederick Douglass* (Harmondsworth: Penguin, 1982) chaps. 1–7, pp. 47–87.
3. Henry David Thoreau, ‘Battle of the Ants’ excerpt from ‘Brute Neighbours’, in *Walden* (Oxford: OUP, 1997) chap. 12.
4. Ralph Waldo Emerson, ‘Self Reliance’, in *The Selected Writings of Ralph Waldo Emerson*, ed. with a biographical introduction by Brooks Atkinson (New York: The Modern Library, 1964).
5. Toni Morrison, ‘Romancing the Shadow’, in *Playing in the Dark: Whiteness and Literary Imagination* (London: Picador, 1993) pp. 29–39.

Literary Imagination (London: Picador, 1993) pp. 29–39.

Semester III

Course Code: ENG 132
Course Title: Popular Literature

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

Lewis Carroll: *Through the Looking Glass*

Unit – II:

J.D.Salinger: *The Catcher in the Rye*

Unit – III:

Shyam Selvadurai: *Funny Boy*

Unit – IV:

Durgabai Vyam and Subhash Vyam: *Bhimayana: Experiences of Untouchability*/ Autobiographical Notes on Ambedkar (For the Visually Challenged students)

Unit – V:

Unseen Passages: Locate and Annotate (From Unit I and II)

Suggested Topics and Background Prose Readings for Class Presentations and Assignments.

Coming of Age
 The Canonical and the Popular
 Caste, Gender and Identity
 Ethics and Education in Children's Literature
 Sense and Nonsense
 The Graphic Novel

Recommended Readings

1. Chelva Kanaganayakam, 'Dancing in the Rarefied Air: Reading Contemporary Sri Lankan Literature' (*ARIEL*, Jan. 1998) rpt, Malashri Lal, Alamgir Hashmi, and Victor J. Ramraj, eds., *Post Independence Voices in South Asian Writings* (Delhi: Doaba Publications, 2001) pp. 51–65.
2. Sumathi Ramaswamy, 'Introduction', in *Beyond Appearances?: Visual Practices and Ideologies in Modern India* (Sage: Delhi, 2003) pp. xiii–xxix.
3. Leslie Fiedler, 'Towards a Definition of Popular Literature', in *Super Culture: American Popular Culture and Europe*, ed. C.W.E. Bigsby (Ohio: Bowling Green University Press, 1975) pp. 29–38.
4. Felicity Hughes, 'Children's Literature: Theory and Practice', *English Literary History*, vol. 45, 1978, pp. 542–61.

Semester III

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: ENG 133

Course Title: British Poetry and Drama: 17th and 18th Centuries

Unit – I:

John Milton: *Paradise Lost*, Book I

Unit – II:

John Webster: *The Duchess of Malfi*

Unit – III:

Aphra Behn: *The Rover*

Unit – IV:

Alexander Pope: *The Rape of the Lock*

Unit- V:

Unseen Passages: Locate and Annotate (Unit I and IV)

Suggested Topics and Background Prose Readings for Class Presentations and Assignments.

Religious and Secular Thought in the 17th Century

The Stage, the State and the Market

The Mock-epic and Satire

Women in the 17th Century The

Comedy of Manners

Recommended Readings

1. The Holy Bible, *Genesis*, chaps. 1–4, *The Gospel according to St. Luke*, chaps. 1–7 and 22–4.
2. Niccolo Machiavelli, *The Prince*, ed. and tr. Robert M. Adams (New York: Norton, 1992) chaps. 15, 16, 18, and 25.
3. Thomas Hobbes, selections from *The Leviathan*, pt. I (New York: Norton, 2006) chaps. 8, 11, and 13.
4. John Dryden, 'A Discourse Concerning the Origin and Progress of Satire', in *The Norton Anthology of English Literature*, vol. 1, 9th edn, ed. Stephen Greenblatt (New York: Norton 2012) pp. 1767–8.

Semester IV

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: ENG 141

Course Title: British Literature: 18th Century

Unit – I:

William Congreve: *The Way of the World*

Unit – II:

Jonathan Swift: *Gulliver's Travels*

Unit – III:

Samuel Johnson: 'London'

Unit- IV:

Thomas Gray: 'Elegy Written in a Country Churchyard'

Unit – V:

Laurence Sterne: *The Life and Opinions of Tristram Shandy, Gentleman*

Suggested Topics and Background Prose Readings for Class Presentations and Assignments.

The Enlightenment and Neoclassicism
 Restoration Comedy
 The Country and the City
 The Novel and the Periodical Press

Recommended Readings

1. Jeremy Collier, *A Short View of the Immorality and Profaneness of the English Stage* (London: Routledge, 1996).
2. Daniel Defoe, 'The Complete English Tradesman' (Letter XXII), 'The Great Law of Subordination Considered' (Letter IV), and 'The Complete English Gentleman', in *Literature and Social Order in Eighteenth-Century England*, ed. Stephen Copley (London: Croom Helm, 1984).
3. Samuel Johnson, 'Essay 156', in *The Rambler*, in *Selected Writings: Samuel Johnson*, ed. Peter Martin (Cambridge, Mass.: Harvard University Press, 2009) pp. 194–7; *Rasselas* Chapter 10; 'Pope's Intellectual Character: Pope and Dryden Compared', from *The Life of Pope*, in *The Norton Anthology of English Literature*, vol. 1, ed. Stephen Greenblatt, 8th edn (New York: Norton, 2006) pp. 2693–4, 2774–7.

Semester IV

Course Code: ENG 142
Course Title: British Romantic Literature

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

William Blake: ‘The Lamb’ from *Songs of Innocence*
 ‘The Tyger’ from *Songs of Experience*
 ‘The Chimney Sweeper’ from *Songs of Innocence*

Unit II:

Robert Burns: ‘A Man’s a Man for a ‘That’
 Lord Byron: ‘She Walks in Beauty’
 ‘Sonnet on Chillon’

Unit – III:

William Wordsworth: ‘Tintern Abbey’
 Samuel Taylor Coleridge: ‘Kubla Khan’
 ‘Dejection: An Ode’

Unit – IV:

Percy Bysshe Shelley: ‘Ode to the West Wind’
 John Keats: ‘Ode to a Nightingale’
 ‘To Autumn’

Unit – V:

Mary Shelley: *Frankenstein*

Suggested Topics and Background Prose Readings for Class Presentations and Assignments.

Reason and Imagination
 Conceptions of Nature
 Literature and Revolution
 The Gothic
 The Romantic Lyric

Recommended Readings

1. William Wordsworth, ‘Preface to Lyrical Ballads’, in *Romantic Prose and Poetry*, ed. Harold Bloom and Lionel Trilling (New York: OUP, 1973) pp. 594–611.
2. John Keats, ‘Letter to George and Thomas Keats, 21 December 1817’, and ‘Letter to Richard Woodhouse, 27 October, 1818’, in *Romantic Prose and Poetry*, ed. Harold Bloom and Lionel Trilling (New York: OUP, 1973) pp. 766–68, 777–8.
3. Jean-Jacques Rousseau, ‘Preface’ to *Emile or Education*, tr. Allan Bloom (Harmondsworth: Penguin, 1991). . Samuel Taylor Coleridge, *Biographia Literaria*, ed. George Watson (London: Everyman, 1993) chap. XIII, pp. 161–66.

Semester IV

Course Code: ENG 143
Course Title: British Literature: 19th Century

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

Jane Austen: *Pride and Prejudice*

Unit – II:

Charlotte Bronte: *Jane Eyre*

Unit – III:

Charles Dickens: *A Tale of Two Cities*

Unit – IV:

Alfred Tennyson: ‘The Lady of Shalott’
‘Ulysses’

Unit V:

Robert Browning: ‘My Last Duchess’
Christina Rossetti: ‘The Goblin Market’

Suggested Topics and Background Prose Readings for Class Presentations

Topics

Utilitarianism
The 19th Century Novel
Marriage and Sexuality
The Writer and Society
Faith and Doubt
The Dramatic Monologue

Recommended Readings

1. Karl Marx and Friedrich Engels, ‘Mode of Production: The Basis of Social Life’, ‘The Social Nature of Consciousness’, and ‘Classes and Ideology’, in *A Reader in Marxist Philosophy*, ed. Howard Selsam and Harry Martel (New York: International Publishers, 1963) pp. 186–8, 190–1, 199–201.
2. Charles Darwin, ‘Natural Selection and Sexual Selection’, in *The Descent of Man in The Norton Anthology of English Literature*, 8th edn, vol. 2, ed. Stephen Greenblatt (New York: Norton, 2006) pp. 1545–9.
3. John Stuart Mill, *The Subjection of Women* in *Norton Anthology of English Literature*, 8th edn, vol. 2, ed. Stephen Greenblatt (New York: Norton, 2006) chap. 1, pp. 1061–9.

Semester V

Course Code: ENG 151
Course Title: Women's Writing

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

Emily Dickinson: 'I'm wife; I've finished that'
 Sylvia Plath: 'Daddy'

Unit – II:

Alice Walker: *The Color Purple*

Unit – III:

Charlotte Perkins Gilman: 'The Yellow Wallpaper'
 Katherine Mansfield: 'Bliss'

Unit – IV:

Mary Wollstonecraft: *A Vindication of the Rights of Woman* (New York: Norton, 1988) chap. 1, pp. 11–19; chap. 2, pp. 19–38.

Unit-V:

Ramabai Ranade: 'A Testimony of our Inexhaustible Treasures' in *Pandita Ramabai Through Her Own Words: Selected Works*, tr. Meera Kosambi (New Delhi: OUP, 2000) pp. 295-324

Suggested Topics and Background Prose Readings for Class Presentations and Assignments.

The Confessional Mode in Women's Writing
 Sexual Politics
 Race, Caste and Gender
 Social Reform and Women's Rights

Recommended Readings

1. Virginia Woolf, *A Room of One's Own* (New York: Harcourt, 1957) chaps. 1 and 6.
2. Simone de Beauvoir, 'Introduction', in *The Second Sex*, tr. Constance Borde and Shiela Malovany-Chevallier (London: Vintage, 2010) pp. 3–18.
3. Kumkum Sangari and Sudesh Vaid, eds., 'Introduction', in *Recasting Women: Essays in Colonial History* (New Delhi: Kali for Women, 1989) pp. 1–25.
4. Chandra Talapade Mohanty, 'Under Western Eyes: Feminist Scholarship and Colonial Discourses', in *Contemporary Postcolonial Theory: A Reader*, ed. Padmini Mongia (New York: Arnold, 1996) pp. 172–97.

Semester V

Course Code: ENG 152

Course Title: British Literature: The Early 20th Century

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:Joseph Conrad: *Heart of Darkness***Unit – II:**G.B. Shaw: *Pygmalion***Unit –III:**Virginia Woolf: *To the Lighthouse***Unit – IV:**W.B. Yeats: 'The Second Coming'
'Sailing to Byzantium'**Unit- V:**T.S. Eliot: 'The Love Song of J. Alfred Prufrock'
'Journey of the Magi'**Suggested Topics and Background Prose Readings for Class Presentations
Topics**

Modernism, Post-modernism and non-European Cultures
The Women's Movement in the Early 20th Century
Psychoanalysis and the Stream of Consciousness
The Uses of Myth
The Avant Garde

Recommended Readings

1. Sigmund Freud, 'Theory of Dreams', 'Oedipus Complex', and 'The Structure of the Unconscious', in *The Modern Tradition*, ed. Richard Ellman et. al. (Oxford: OUP, 1965) pp. 571, 578–80, 559–63.
2. T.S. Eliot, 'Tradition and the Individual Talent', in *Norton Anthology of English Literature*, 8th edn, vol. 2, ed. Stephen Greenblatt (New York: Norton, 2006) pp. 2319–25.
3. Raymond Williams, 'Introduction', in *The English Novel from Dickens to Lawrence* (London: Hogarth Press, 1984) pp. 9–27.

Semester VI

Course Code: ENG 161
Course Title: Modern European Drama

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

Henrik Ibsen: *Ghosts*

Unit – II:

Bertolt Brecht: *Mother Courage and Her Children*

Unit – III:

Samuel Beckett: *Waiting for Godot*

Unit – IV:

Eugene Ionesco: *Rhinoceros*

Unit- V:

Unseen Passages: Locate and Annotate (Unit II and IV)

Suggested Topics and Background Prose Readings for Class Presentations and Assignments.

Politics, Social Change and the Stage

Text and Performance

European Drama: Realism and Beyond

Tragedy and Heroism in Modern European Drama

The Theatre of the Absurd

Recommended Readings

1. Constantin Stanislavski, *An Actor Prepares*, chap. 8, 'Faith and the Sense of Truth', tr. Elizabeth Reynolds Hapgood (Harmondsworth: Penguin, 1967) sections 1, 2, 7, 8, 9, pp. 121–5, 137–46.
2. Bertolt Brecht, 'The Street Scene', 'Theatre for Pleasure or Theatre for Instruction', and 'Dramatic Theatre vs Epic Theatre', in *Brecht on Theatre: The Development of an Aesthetic*, ed. and tr. John Willet (London: Methuen, 1992) pp. 68–76, 121–8.
3. George Steiner, 'On Modern Tragedy', in *The Death of Tragedy* (London: Faber, 1995) pp. 303–24.

Semester VI

Course Code: ENG 162
Course Title: Postcolonial Literature

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

Chinua Achebe: *Things Fall Apart*

Unit – II:

Gabriel Garcia Marquez: *Love in the Time of Cholera*

Unit – III:

Bessie Head: 'The Collector of Treasures'
 Grace Ogot: 'The Green Leaves'

Unit – IV:

Pablo Neruda: 'Tonight I Can Write'
 Derek Walcott: 'A Far Cry from Africa'
 'Names'

Unit – V:

Mamang Dai: 'Small Towns and the River'
 'The Voice of the Mountain'
 Robin S. Ngangom 'A Poem for Mother'

Suggested Topics and Background Prose Readings for Class Presentations Topics

De-colonization, Globalization and Literature
 Literature and Identity Politics Writing for
 the New World Audience Region, Race, and
 Gender
 Postcolonial Literatures and Questions of Form

Recommended Readings

1. Franz Fanon, 'The Negro and Language', in *Black Skin, White Masks*, tr. Charles Lam Markmann (London: Pluto Press, 2008) pp. 8–27.
2. Ngugi wa Thiong'o, 'The Language of African Literature', in *Decolonising the Mind* (London: James Curry, 1986) chap. 1, sections 4–6.
3. Gabriel Garcia Marquez, the Nobel Prize Acceptance Speech, in *Gabriel Garcia Marquez: New Readings*, ed. Bernard McGuirk and Richard Cardwell (Cambridge: Cambridge University Press, 1987).

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSEC)**Semester V**

Course Code: ENG 251
Course Title: Literature of the Indian Diaspora

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

M. G. Vassanji: *The Book of Secrets*

Unit – II:

Jhumpa Lahiri: *The Namesake*

Unit – III:

Bharati Mukherjee: ‘The Lady from Lucknow’ and
‘The Imaginary Assassin’ from the short story collection *Darkness*

Unit – IV:

Meena Alexander: ‘House of a Thousand Doors’
‘River and Bridge’

Unit- V:

Ayub Khan-Din: *East is East* (Directed by Damien O’Donnell, 1999): An Introduction to Film Study

Suggested Topics and Background Prose Readings for Class Presentations:

The Diaspora
Nostalgia
New Medium
Alienation

Recommended Reading

1. “Introduction: The diasporic imaginary” in Mishra, V. (2008). *Literature of the Indian diaspora*. London: Routledge
 2. “Cultural Configurations of Diaspora,” in Kalra, V. Kaur, R. and Hutynuk, J. (2005). *Diaspora & hybridity*. London: Sage Publications.
 3. “The New Empire within Britain,” in Rushdie, S. (1991). *Imaginary Homelands*. London: Granta Books.
- ‘Border Visions: Identity and Diaspora in Film’ Ed. Jakub Kazecki Karen.A. Ritzenhoff and Cynthia J. Miller.(2013). Scarecrow Press.

Semester V

Course Code: ENG 252
Course Title: Literary Criticism

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

William Wordsworth: Preface to the *Lyrical Ballads* (1802)

Unit – II:

T.S. Eliot: ‘Tradition and the Individual Talent’ 1919
 ‘The Function of Criticism’ 1920

Unit – III:

I.A. Richards: *Principles of Literary Criticism* Chapters 1, 2 and 34. London 1924.

Unit – IV:

Cleanth Brooks: “The Language of Paradox” in *The Well-Wrought Urn: Studies in the Structure of Poetry* (1947)

Unit- V:

Practical Criticism: Unseen Passages: Prose & Poetry

Suggested Topics and Background Prose Readings for Class Presentations Topics

Summarizing and Critiquing
 Point of View
 Reading and Interpreting
 Media Criticism
 Plot and Setting
 Citing from Critics’ Interpretations

Recommended Readings

1. C.S. Lewis: Introduction in *An Experiment in Criticism*, Cambridge University Press 1992
2. M.H. Abrams: *The Mirror and the Lamp*, Oxford University Press, 1971
3. Rene Wellek, Stephen G. Nicholas: *Concepts of Criticism*, Connecticut, Yale University 1963
 Taylor and Francis Eds.: *An Introduction to Literature, Criticism and Theory*, Routledge, 1996

Semester VI

Course Code: ENG 261
Course Title: Literary Theory

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I: Marxism

Louis Althusser, 'Ideology and Ideological State Apparatuses', in *Lenin and Philosophy and Other Essays* (New Delhi: Aakar Books, 2006) pp. 85–126.

Unit – II: Feminism

Elaine Showalter, 'Twenty Years on: A Literature of Their Own Revisited', in *A Literature of Their Own: British Women Novelists from Bronte to Lessing* (1977. Rpt. London: Virago, 2003) pp. xi–xxxiii.

Unit – III: Poststructuralism

Jacques Derrida, 'Structure, Sign and Play in the Discourse of the Human Science', tr. Alan Bass, in *Modern Criticism and Theory: A Reader*, ed. David Lodge (London: Longman, 1988) pp. 108–23.

Unit – IV: Postcolonial Studies

Mahatma Gandhi, 'Passive Resistance' and 'Education', in *Hind Swaraj and Other Writings*, ed. Anthony J Parel (Delhi: CUP, 1997) pp. 88–106

Unit -V: Contemporary Postcolonial Studies

Homi K. Bhabha: 'Narrating the Nation' in "Nation and Narration" (Routledge: Indian Edition, 2008) pp. 1–7.

Suggested Background Prose Readings and Topics for Class Presentations

Topics

The East and the West
 Questions of Alterity
 Power, Language, and Representation
 The State and Culture

Recommended Readings

1. Terry Eagleton, *Literary Theory: An Introduction* (Oxford: Blackwell, 2008).
2. Peter Barry, *Beginning Theory* (Manchester: Manchester University Press, 2002).

Semester VI

Course Code: ENG 262
Course Title: Science Fiction and Detective Literature

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

Wilkie Collins: *The Woman in White*

Unit – II:

Arthur Conan Doyle: *The Hound of the Baskervilles*

Unit –III:

Raymond Chandler: *The Big Sleep*

Unit – IV:

H.G.Wells: *The Time Machine*

Unit – V:

Isaac Asimov: *The Last Question*

Suggested Topics and Readings for Class Presentation Topics

Crime across the Media
 Constructions of Criminal Identity Cultural
 Stereotypes in Crime Fiction Crime Fiction
 and Cultural Nostalgia Crime Fiction and
 Ethics
 Crime and Censorship
 Science Fiction and Speculative Fiction
 Science Fiction and Technology

Recommended Readings

1. Robert Scholes; Eric S.Rabkin: *Science Fiction: History, Science, Vision* (London: Oxford University Press, 1977)
2. Adam Roberts: *The History of Science Fiction* (Palgrave Macmillan, 2005)
3. Michael Cox: *Victorian Tales of Mystery and Detection: An Oxford Anthology* (Oxford University Press, 1992)
4. Julian Symons: *Bloody Murder: From the Detective Story to the Crime Novel: A History* (Penguin Books Ltd. 1974)

GENERIC ELECTIVE COURSE (GEC)**Semester I**

Course Code: ENG 311
Course Title: Academic Writing and Composition

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

- (a) Introduction to the Writing Process
- (b) Introduction to the Conventions of Academic Writing

Unit – II:

- (a) Writing in one's own words: Summarizing and Paraphrasing
- (b) Critical Thinking: Analyses and Evaluation

Unit – III:

Assignment Writing: Academic style of writing assignments and working Bibliography/works cited

Unit – IV:

Composition: Writing of letters to authorities, friends and parents, preparing a CV

Unit – V:

Book review and essay writing.

Recommended Readings

1. Liz Hamp-Lyons and Ben Heasley, *Study writing: A Course in Writing Skills for Academic Purposes* (Cambridge: CUP, 2006).
2. Renu Gupta, *A Course in Academic Writing* (New Delhi: Orient BlackSwan, 2010).
3. Ilona Leki, *Academic Writing: Exploring Processes and Strategies* (New York: CUP, 2nd edn, 1998).
4. Gerald Graff and Cathy Birkenstein, *They Say/I Say: The Moves That Matter in Academic Writing* (New York: Norton, 2009).
5. Sebastian, A. J. & Eds., *Prosaic Musings*, Nagaland Univ. Macmillan.

Semester II

Course Code: ENG 321
Course Title: Media and Communication Skills

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I: Introduction to Mass Communication

1. Mass Communication
2. Forms of Mass Communication

Topics for Student Presentations:

1. Case studies on current issues Indian journalism
2. Performing street plays
3. Writing pamphlets and posters, etc.

Unit – II: Advertisement

1. Types of advertisements
2. Advertising ethics
3. How to create advertisements/storyboards

Topics for Student Presentations:

- a. Creating an advertisement/visualization
- b. Enacting an advertisement in a group
- c. Creating jingles and taglines

Unit – III: Media Writing

1. Scriptwriting for TV and Radio
2. Writing News Reports and Editorials

Topics for Student Presentations:

Script writing for a TV news/panel discussion/radio programme/hosting radio programmes on community radio
 Editing articles

Unit – IV: Introduction to Cyber Media and Social Media

1. Types of Social Media
2. The Impact of Social Media
3. Introduction to Cyber Media

Unit – V: Creative Writing and Presentation

1. Writing news reports
2. Writing book reviews/film reviews/TV program reviews
3. Conducting Interviews
- 4.

Recommended Readings

1. Barker, L. Larry. *Communication*. New Jersey: Prentice-Hall, 1990.
 2. Denis, McQuail. *Mass Communication Theories: An Introduction*. London: Sage, 1987.
 3. Fiske, John, *Introduction to Communication Studies*. London: Methuen, 1982.
 4. Jones, Stephen. *Handbook of New Media*. London: Sage, 2003.
 5. Krishna Murthy, Nadig. *Indian Journalism: Origin and Growth of Indian Journalism from Asoka to Nehru*. Prasaranga: U of Mysore P, 1966.
 6. Metha, D.S. *Mass Communication and Journalism in India*. Allied: New Delhi, 1992.
 7. Monaco, James. *How to Read a Film*. New York, OUP, USA, 2000
- MLA Handbook of Mass Communication

Semester III

Course Code: ENG 331
Course Title: Poetry, Short Stories and One-Act Play

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

William Wordsworth: ‘Written in Early Spring’
 Matthew Arnold: ‘Dover Beach’
 Wilfred Owen: ‘Anthem for Doomed Youth’
 Kamala Das: ‘Punishment in the Kindergarten’

Unit – II:

Anton Chekov: ‘The Bet’
 R. K. Narayan: ‘Lawley Road’

Unit – III:

Norman Mckinnel: ‘The Bishop’s Candlesticks’

Unit – IV:

A. Milne: ‘The Portrait of a Gentleman in Slippers’

Unit – V:

Edgar Wallace: ‘The Forest of Happy Dreams’

Semester IV

Course Code: ENG 341
Course Title: Drama and Fiction

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit – I:

William Shakespeare: *The Merchant of Venice*

Unit – II:

Christopher Marlowe: *The Jew of Malta*

Unit – III:

Charles Dickens: *David Copperfield*

Unit – IV:

Earnest Hemingway: *The Old Man and the Sea*

Unit – V:

Unseen Passages from Unit I and Unit II

ABILITY ENHANCEMENT COMPULSORY COURSE

Offered in **First Semester** for Science Stream: Science and Computer

Offered in **Second Semester** for Arts Stream: Arts & Music

| | | | |
|----------------|-------|-------|-------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 0:50 | - | - |

Course Code: ENG 411 (B. Sc. & B. C. A.B.Mus)/**ENG 421** (B. A. & Mass Com)

Course Title: English Communication

Unit – I:

Introduction: Theory of Communication, Type of Communication.

Unit – II:

Language of Communication: Verbal and Non-Verbal
Barriers to Communication

Unit – III:

Speaking Skills: Dialogue, Group Discussion, Interview and Public Speech

Unit – IV:

Reading and Understanding: Close Reading, Comprehension, Analysis and Interpretation

Unit – V:

Writing Skills: Report Writing, Note making, Letter writing, Précis writing,
Common Errors in English

Recommended Readings:

Fluency in English - Part II, Oxford University Press, 2006.

Business English, Pearson, 2008.

Language, Literature and Creativity, Orient Blackswan, 2013.

Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr. Brati Biswas.

1. *Fluency in English - Part II*, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. Bovee and Thill, *Business Communication Today*, Pearson Education.
4. Shirley Taylor, *Communication for Business*, Pearson Education.
5. Locker and Kaczmarek, *Business Communication: Building Critical Skills*, TMH.

Ability Enhancement Compulsory Course (AECC)
For Commerce

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 0:50 | - | - |

AECC for Commerce: Business Communication

Unit – I: Process of Communication
Types of Communication: Formal and Informal
Importance of Communication

Unit – II: Barriers to communication:
Physical Barriers
Mechanical Barriers
Semantic Barriers
Cultural Barriers

Unit – III: Business Correspondence:
Inviting quotations
Sending quotations
Complaints and Adjustment letters
Agenda and Minutes of Meeting
Job Application Letter and Resume

Unit – IV: Business report writing:
Types, Characteristics, Importance, Elements of structure,

Unit – V: Oral Presentation Skills:
Extempore Speech
Mock Interviews

Recommended Readings:

1. Lesikar, R.V. & Flatley, M.E.; *Basic Business Communication Skills for Empowering the Internet Generation*, Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. *Fluency in English - Part II*, Oxford University Press, 2006.
3. *Business English*, Pearson, 2008.
4. Bovee and Thill, *Business Communication Today*, Pearson Education.
5. Shirley Taylor, *Communication for Business*, Pearson Education.
6. Locker and Kaczmarek, *Business Communication: Building Critical Skills*, TMH.

SKILL ENHANCEMENT COURSE (SEC)**Semester III**

Course Code: ENG 531
Course Title: English Language Teaching

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Unit – I: Materials for language teaching.
Unit – II: Methods of Teaching English Language.
Unit – III: Assessing Language Skills

Recommended Readings

1. Penny Ur, *A Course in Language Teaching: Practice and Theory* (Cambridge: CUP, 1996).
2. Marianne Celce-Murcia, Donna M. Brinton, and Marguerite Ann Snow, *Teaching English as a Second or Foreign Language* (Delhi: Cengage Learning, 4th edn, 2014).
3. Adrian Doff, *Teach English: A Training Course For Teachers* (Teacher's Workbook) (Cambridge: CUP, 1988).
4. *Business English* (New Delhi: Pearson, 2008).
5. R.K. Bansal and J.B. Harrison, *Spoken English: A Manual of Speech and Phonetics* (New Delhi: Orient BlackSwan, 4th edn, 2013).
6. Mohammad Aslam, *Teaching of English* (New Delhi: CUP, 2nd edn, 2009).

Semester IV

Course Code: ENG 541
Course Title: Business Communication

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Unit – I: Introduction to the essentials of Business Communication: Application for a situation, Sales letter, Trade inquiry, Trade order, Offers and quotations

Unit – II: Writing reports on field work/visits to industries, business concerns etc. /business negotiations

Unit – III: Writing minutes of meetings and Spoken English for business communication.

Recommended Readings:

1. Scot, O.; *Contemporary Business Communication*. Biztantra, New Delhi.
2. Lesikar, R.V. & Flatley, M.E.; *Basic Business Communication Skills for Empowering the Internet Generation*, Tata McGraw Hill Publishing Company Ltd. New Delhi.
3. Ludlow, R. & Panton, F.; *The Essence of Effective Communications*, Prentice Hall Of India Pvt. Ltd., New Delhi.
4. R. C. Bhatia, *Business Communication*, Ane Books Pvt Ltd, New Delhi.
5. Leigh, Judith. *CVs and Applications*
6. Pillai, R.S.N and Bagavathi. *Modern Commercial Correspondence*. S. Chand
7. Majumdar, W.M. *Commercial Correspondence*. Bookland Pvt. Ltd
8. Jones, Leo and Alexander Richard. *New International Business English: Communication Skills in English for Business Purpose*. CUP
9. Firth, A. *The Discourse of Negotiation: Studies of Language in the Workplace*. Elsevier
10. Irvine, Mark and Cadman, Marion. *Commercially Speaking*. OUP

HISTORY HONOURS

| Semester | Core Course | Ability Enhancement Courses | Skill Enhancement Courses | Discipline Specific Elective Course | Generic Elective Course |
|--------------------------------|---|-----------------------------|----------------------------|-------------------------------------|-------------------------------|
| First | History of India I (6) | Environmental Studies (2) | | | History of Ancient India (6) |
| | Social Formations & Cultural Patterns of Ancient World (6) | | | | |
| Second | History of India II (6) | English Communication (2) | | | History of Medieval India (6) |
| | Social Formations & Cultural Patterns of Medieval World (6) | | | | |
| Third | History of India III (6) | | Understanding Heritage (2) | | History of Modern India (6) |
| | Rise of Modern West I (6) | | | | |
| | History of North East India (6) | | | | |
| Fourth | History of India IV (6) | | Archives and Museums (2) | | History of the Nagas (6) |
| | Rise of Modern West II (6) | | | | |
| | History of the Nagas (6) | | | | |
| Fifth | History of India V (6) | | | History of USA I (6) | |
| | Modern Europe I (6) | | | History of USA II (6) | |
| Sixth | History of India VI (6) | | | History of East Asia I (6) | |
| | Modern Europe II (6) | | | History of East Asia II (6) | |
| No. of Courses (Credit) | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |

CORE COURSE**Semester I****Course Code: HIS 111****Course Title: HISTORY OF INDIA (Prehistory to c.300 BC) - I**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

I. Reconstructing Ancient Indian History

Early Indian notions of History [b] Sources and tools of historical reconstruction. [c] Historical interpretations (with special reference to gender, environment, technology, and regions).

II. Pre-historic hunter-gatherers

Paleolithic cultures- sequence and distribution; stone industries and other technological developments. [b] Mesolithic cultures- regional and chronological distribution; new developments in technology and economy; rock art.

III. The advent of food production

Understanding the regional and chronological distribution of the Neolithic and Chalcolithic cultures: subsistence, and patterns of exchange

IV. The Harappan civilization

Origins; settlement patterns and town planning; agrarian base; craft productions and trade; social and political organization; religious beliefs and practices; art; the problem of urban decline and the late/post-Harappan traditions.

V. Cultures in transition

Settlement patterns, technological and economic developments; social stratification; political relations; religion and philosophy; the Aryan Problem.

North India (circa 1500 BCE-300 BCE) [b] Central India and the Deccan (circa 1000 BCE - circa 300 BCE) [c] Tamilakam (circa 300 BCE to circa CE 300)

Essential Readings:

1. R.S. Sharma, India's Ancient Past, New Delhi, OUP, 2007
2. R. S. Sharma, Material Culture and Social Formations in Ancient India, 1983.
3. R.S. Sharma, Looking for the Aryas, Delhi, Orient Longman Publishers, 1995
4. D. P. Agrawal, The Archaeology of India, 1985
5. Bridget & F. Raymond Allchin, The Rise of Civilization in India and Pakistan, 1983.
6. A. L. Basham, The Wonder that Was India, 1971.
7. D. K. Chakrabarti, The Oxford Companion to Indian Archaeology, New Delhi, 2006. 8. H. C. Raychaudhuri, Political History of Ancient India, Rev. ed. with Commentary by B. N. Mukherjee, 1996
9. K. A. N. Sastri, ed., History of South India, OUP, 1966.
10. Upinder Singh, A History of Ancient and Early Medieval India, 2008. Romila Thapar, Early India from the Beginnings to 1300, London, 2002.
11. Irfan Habib, A People's History-Vol. -1, PreHistory, 2001, ---Vol.-2, Indus Civilization: Including Other Copper Age Cultures and the History of Language Change till 155 B.C., 2002

Suggested Readings

1. Uma Chakravarti, The Social Dimensions of Early Buddhism. 1997.
2. Rajan Gurukul, Social Formations of Early South India, 2010.
3. R. Champakalakshmi, Trade. Ideology and urbanization: South India 300 BC- AD 1300, 1996.

Semester I

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: HIS 112

Course Title: SOCIAL FORMATIONS AND CULTURAL PATTERNS OF THE ANCIENT WORLD

I. Evolution of humankind; Paleolithic and Mesolithic cultures. Food production: beginnings of agriculture and animal husbandry.

II. Bronze Age Civilizations, with reference to any one of the following: i) Egypt (Old Kingdom); ii) Mesopotamia (up to the Akkadian Empire); iii) China (Shang); IV) Eastern Mediterranean (Minoan) economy, social stratification, state structure, religion.

III. Nomadic groups in Central and West Asia; Debate on the advent of iron and its implications

IV. Slave society in ancient Greece: agrarian economy, urbanization, trade.

V. Polis in ancient Greece: Athens and Sparta; Greek Culture.

ESSENTIAL READINGS

1. Burns and Ralph. World Civilizations. Cambridge History of Africa, Vol. I. V. Gordon Childe, What Happened in History.
2. G. Clark, World Prehistory: A New Perspective.
3. B. Fagan, People of the Earth. Amar Farooqui, Early Social Formations.
4. M.I. Finley, The Ancient Economy.
5. Jacquetta Hawkes, First Civilizations.
6. G. Roux, Ancient Iraq.
7. Bai Shaoyi, An Outline History of China.
8. H. W. F. Saggs, The Greatness that was Babylon.
9. B. Trigger, Ancient Egypt: A Social History.
10. UNESCO Series: History of Mankind, Vols. I - III./ or New ed. History of Humanity.
11. R. J. Wenke, Patterns in Prehistory.

SUGGESTED READINGS

1. G. E. M. Ste Croix, Class Struggles in the Ancient Greek World.
2. J. D. Bernal, Science in History, Vol. I.
3. V. Gordon Childe, Social Evolution.

Semester II

Course Code: HIS 121

Course Title: HISTORY OF INDIA II (c.300BC-750AD)

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

I. Economy and Society (circa 300 BCE to circa CE 300):

- (a). Expansion of agrarian economy: production relations.
 [b] Urban growth: north India, central India and the Deccan; craft Production: trade and trade routes; coinage.
 [c] Social stratification: class, Varna, jati, untouchability; gender; marriage and property relations

II. Changing political formations (circa 300 BCE to circa CE 300):

- (a). The Mauryan Empire
 [b] Post-Mauryan Polities with special reference to the Kushanas and the Satavahanas; Gana-Sanghas.

III. Towards early medieval India [circa CE fourth century to CE 750]:

- [a] Agrarian expansion: land grants, changing production relations; graded Land rights and peasantry.
 [b] The problem of urban decline: patterns of trade, currency, and urban Settlements.
 [c] Varna, proliferation of jatis: changing norms of marriage and property. [d] The nature of polities: the Gupta empire and its contemporaries: post- Gupta polities -Pallavas, Chalukyas, and Vardhanas

IV. Religion, philosophy and society (circa 300 BCE- CE 750):

- (a). Consolidation of the brahmanical tradition: dharma, Varnashram, Purusharthas, samskaras.
 (b) Theistic cults (from circa second century BC): Mahayana; the Puranic tradition.
 (c) The beginnings of Tantricism

V. Cultural developments (circa 300 BCE û CE 750):

- (a). A brief survey of Sanskrit, Pali, Prakrit and Tamil literature. Scientific and technical treatises
 [b] Art and architecture & forms and patronage; Mauryan, post- Mauryan, Gupta, post-Gupta

ESSENTIAL READINGS

1. B. D. Chattopadhyaya, The Making of Early Medieval India, 1994.
2. D. P. Chattopadhyaya, History of Science and Technology in Ancient India, 1986.
3. D.D. Kosambi, An Introduction to the Study of Indian History, 1975.
4. S.K. Maity, Economic Life in Northern India in the Gupta Period, 1970.
5. B. P. Sahu (ed), Land System and Rural Society in Early India, 1997.
6. K. A. N. Sastri, A History of South India.
7. R. S. Sharma, Indian Feudalism, 1980.
8. R.S.Sharma,UrbanDecay in India,c.300- C1000,Delhi,Munshiram Manohar Lal,1987 Romila Thapar, Asoka and the Decline of the Mauryas, 1997.
9. Susan Huntington, The Art of Ancient India: Buddhist, Hindu, and Jain, New York, 1985.

SUGGESTED READINGS

1. N. N. Bhattacharya, Ancient Indian Rituals and Their Social Contents, 2nd ed., 1996. J. C. Harle, The Art and Architecture of the Indian Subcontinent, 1987.
2. P. L. Gupta, Coins, 4th ed., 1996.
3. Kesavan Veluthat, The Early Medieval in South India, New Delhi, 2009
4. H. P. Ray Winds of Change, 1994.
5. Romila Thapar, Early India: From the Origins to 1300, 2002.

Semester II

Course Code: HIS 122

Course Title: SOCIAL FORMATIONS AND CULTURAL PATTERNS OF THE MEDIEVAL WORLD

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

I. Roman Republic, Participate and Empire & slave society in ancient Rome: Agrarian economy, urbanization, trade.

II. Religion and culture in ancient Rome. Crises of the Roman Empire.

III. Economic developments in Europe from the 7th to the 14th centuries: Organization of production, towns and trade, technological developments. Crisis of feudalism.

IV. Religion and culture in medieval Europe:

V. Societies in Central Islamic Lands:

- (a) The tribal background, ummah, Caliphal state; rise of Sultanates
- (b) Religious developments: the origins of shariah, Mihna, Sufism
- (c) Urbanization and trade

ESSENTIAL READINGS

1. Perry Anderson, Passages from Antiquity to Feudalism.
2. Marc Bloch, Feudal Society, 2 Vols.
3. Cambridge History of Islam, 2 Vols.
4. Georges Duby, The Early Growth of the European Economy.
5. Fontana, Economic History of Europe, Vol. I (relevant chapters).
6. P. K. Hitti, History of the Arabs.
7. P. Garnsey and Saller, The Roman Empire.

SUGGESTED READINGS

1. S. Ameer Ali, The Spirit of Islam.
2. J. Barrowclough, The Medieval Papacy.
3. Encyclopedia of Islam, 1st ed., 4 vols.
4. M. G. S. Hodgson, The Venture of Islam.

Semester III

Course Code: HIS 131
Course Title: HISTORY OF INDIA (750 -1550) - III

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

I. Studying Early Medieval India:

- a) Historical geography Sources: texts, epigraphic and numismatic data, Debates on Indian feudalism, rise of the Rajputs and the nature of the state
 (b) Evolution of political structures: Rashtrakutas, Palas, Pratiharas, Rajputs and Cholas
 (c) Arab conquest of Sindh: (d) Causes and consequences of early Turkish invasions: Mahmud of Ghazna; Shahab-ud-Din of Ghur

II. The Delhi Sultanate:

Survey of sources: Persian tarikh tradition; vernacular histories; epigraphy. Foundation, expansion and consolidation of the Sultanate of Delhi; The Khaljis and the Tughluqs; Mongol threat and Timur's invasion; The Lodis: Conquest of Bahlul and Sikandar; Ibrahim Lodi and the battle of Panipat

III. Theories of kingship; Ruling elites; Sufis, ulama and the political authority; imperial monuments and coinage (c) Emergence of provincial dynasties: Bahamani and Vijayanagar.

IV. Society and Economy:

- (a) Iqta and the revenue-free grants
 (b) Agricultural production; technology (c) Changes in rural society; revenue systems (d) Monetization; market regulations; growth of urban centers; trade and commerce; Indian Ocean trade

V. Religion, Society and Culture:

- (a) Sufi silsilas: Chishtis and Suhrawardis; doctrines and practices; social roles
 (b) Bhakti movements and monotheistic traditions in South and North India; Women Bhaktas;
 (c) Nathpanthis; Kabir, Nanak and the Sant tradition (c) Sufi literature.

ESSENTIAL READINGS

1. R.S. Sharma, Indian Feudalism (circa 300 – 1200).
2. B.D. Chattopadhyaya, The Making of Early Medieval India.
3. R.S. Sharma and K.M. Shrivastava, eds, Comprehensive History of India, Vol. IV (A & B).
4. Mohammad Habib and K.A. Nizami, eds, Comprehensive History of India, Vol. V,
5. The Delhi Sultanate Hermann Kulke, ed., The State in India (AD 1000 - AD 1700).
6. N. Karashima, South Indian History and Society (Studies from Inscriptions, AD 850 -1800
7. Derryl N. Maclean, Religion and Society in Arab Sindh.
8. Irfan Habib, Medieval India: The Study of a Civilization.
9. Mohammad Habib and K.A. Nizami, eds, Comprehensive History of India, Vol. V,
10. The Delhi Sultanate. Satish Chandra, Medieval India I.
11. Peter Jackson, The Delhi Sultanate.
12. Catherine Asher and Cynthia Talbot, India Before Europe.
13. Tapan Raychaudhuri and Irfan Habib, eds, Cambridge Economic History of India, Vol. I
14. K.A. Nizami, Religion and Politics in the Thirteenth Century.
15. W.H. McLeod, Karine Schomer, et al, Eds, The Sants.
16. S.A.A. Rizvi, A History of Sufism in India, Vol. I.
17. Mohibul Hasan, Historians of Medieval India

Semester III

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: HIS 132**Course Title: RISE OF THE MODERN WEST - I**

I. Transition from feudalism to capitalism: problems and theories. Early colonial expansion: motives, voyages and explorations; the conquests of the Americas: beginning of the era of colonization; mining and plantation; the African slaves.

II. Renaissance: its social roots, city-states of Italy; spread of humanism in Europe; Art.

III. Origins, course and results of the European Reformation in the 16th century.

IV. Economic developments of the sixteenth century: Shift of economic balance from the Mediterranean to the Atlantic; Commercial Revolution; Influx of American silver and the Price Revolution.

V. Emergence of European state system: Spain; France; England; Russia

ESSENTIAL READINGS

1. Carlo M. Cipolla, Fontana Economic History of Europe, Vols. II and III.
2. Carlo M. Cipolla, Before the Industrial Revolution, European Society and Economy. 1000 -1700. 3rd ed. (1993)
3. D. C. Coleman (ed.), Revisions in Mercantilism.
4. Ralph Davis, The Rise of the Atlantic Economics.
5. Maurice Dobb, Studies in the Development of Capitalism.
6. J. R. Hale, Renaissance Europe.
7. R. Hall, From Galileo to Newton.
8. Christopher Hill, A Century of Revolutions.
9. Rodney Hilton, Transition from Feudalism to Capitalism.
10. H. G. Koenigsberger and G. L. Mosse, Europe in the Sixteenth Century.
11. Stephen J. Lee, Aspects of European History, 1494 - 1789.
12. G. Parker, Europe in Crisis. 1598- 1648.
13. G. Parker and L. M. Smith, General Crisis of the Seventeenth Century.
14. J. H. Parry, The Age of Reconnaissance.
15. Meenaxi Phukan, Rise of the Modern West: Social and Economic History of Early Modern Europe.
16. Poliensiky, War and Society in Europe, 1618 – 48.
17. Theodore K. Rabb, The Struggle for Stability in Early Modern Europe.
18. Scammell, The First Imperial Age: European Overseas Expansion, 1400 - 1715.

Semester III

Course Code: HIS 133
Course Title: HISTORY OF NORTH EAST INDIA (1824-1947)

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

UNIT I : An introduction to North East India- Land and its people

UNIT II : Early British Policy- First Anglo-Burmese War , Treaty of Yandaboo

UNIT III : Rise and consolidation of British power- Kachar Hills,Khasi Hills, Garo Hills, Naga Hills, Lushei Hills, Jaintia Hills and NEFA

UNIT IV : British relations with Manipur ,Tripura and the Nagas

UNIT V : North East in Indian Struggle for freedom : Revolt of 1857,Non- Cooperation Movement, Civil Disobedience Movement, Quit India Movement.

Suggested Readings:

1. H.Barpujari, Problems of the hill tribes of North East India, Vol I <Guwahati,1970
2. M.S Sangma, history and Culture of the Garo People, Mittal Publications Delhi
3. N.R Roy Choudhury, Tripura through the Ages, Sterling Publishers, New Delhi, 1983.
4. Alemchiba Ao, A Brief Historical Account of Nagaland. Kohima, 1970
5. L.B Thanga, The Mizos, United Publishers, Guwahati. 1978
6. S.K Bhuyan, Anglo- Assamese Relations, Lawyers Book Stall, Guwahati
7. H.K Barpujari, Problems of the Hill Tribes
8. S.K Chaube, Hill Politics in North East India, Orient Longman.

Semester IV

Course Code: HIS 141
Course Title: HISTORY OF INDIA IV (1550 - 1757)

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

I. Sources and Historiography:

Persian literary culture; translations; Vernacular literary traditions, memoirs and travelogues

Establishment of Mughal rule:

India on the eve of Babur's invasion

- (a) Fire arms, military technology and warfare
- (b) Humayun's struggle for empire
- (c) Sher Shah and his administrative and revenue reforms.

II.Consolidation of Mughal rule under Akbar:

- (a) Campaigns and conquests
- (b) Evolution of administrative institutions: zabt, mansab, jagir, madad-i-maash
- (c) Revolts and resistance. **Expansion and Integration:**
 - (a) Incorporation of Rajputs and other indigenous groups in Mughal nobility
 - (b) North-West frontier, Gujarat and the Deccan
 - (c) Conquest of Bengal

III. Rural Society and Economy:

- (a) Land rights and revenue system; Zamindars and peasants
- (b) agricultural production; crop patterns
- (c) Trade routes and patterns of internal commerce; overseas trade; rise of Surat

Political and religious ideals: (a) Inclusive political ideas: theory and practice (b) Religious tolerance and sulh-i-kul; Sufi mystical and intellectual interventions (c) Pressure from the ulama

IV. Political Culture under Jahangir and Shah Jahan:

- (a) Extension of Mughal rule; changes in mansab and jagir systems; imperial culture
- (b) Orthodoxy and syncretism - Naqshbandi Sufis, Miyan Mir, Dara Shukoh, Sarmad.

Mughal Empire under Aurangzeb:

- (a) State and religion under Aurangzeb; issues in the war of succession; policies regarding Religious groups and institutions
- (b) Conquests and limits of expansion
- (c) Beginning of the crisis: agrarian and jagir crises; revolts

V. Patterns of Regional Politics:

- (a) Rajput political culture and state formation
- (b) Deccan kingdoms; emergence of the Marathas; Shiva; expansion under the Peshwas
- (c) Mughal decline; emergence of successor states
- (d) Interpreting eighteenth century India: recent debates

Trade and Commerce:

- (a) Crafts and technologies; Monetary system
- (b) Markets; transportation; urban centres
- (c) Indian Ocean trade network

Visual Culture: Paintings and Architecture

ESSENTIAL READINGS

1. M. Athar Ali, The Mughal Nobility under Aurangzeb.
2. Muzaffar Alam and Sanjay Subramanian, eds, The Mughal State, 1526 - 1750.
3. J.F. Richards, The Mughal Empire.
4. Satish Chandra, Essays on Medieval Indian History.
5. Irfan Habib, Agrarian System of Mughal India, 1526 û 1707.
6. Ashin Dasgupta, Indian Merchants and the Decline of Surat, 1700 - 1750.
7. Stewart Gordon, The Marathas 1600 - 1818. Ebba Koch, Mughal Art and Imperial Ideology.
8. S.A.A. Rizvi, Muslim Revivalist Movements in Northern India.
9. K. R. Qanungo, Dara Shikoh.

Semester IV

Course Code: HIS 142
Course Title: RISE OF THE MODERN WEST - II

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

- I. A)** 17th century European crisis: economic, social and political dimensions.
B) The English Revolution: major issues; political and intellectual currents.
- II.** Rise of modern science in relation to European society from the Renaissance to the 17th century.
- III.** Mercantilism and European economics; 17th and 18th centuries.
- IV.** European politics in the 18th century: parliamentary monarchy; patterns of Absolutism in Europe.
- V. A)** Political and economic issues in the American Revolution.
B) Preludes to the Industrial Revolution

SUGGESTED READINGS

1. T.S. Aston and C.H.E. Philpin (eds.),
2. The Brenner Debate. H. Butterfield, The Origins of Modern Science.
3. Carlo M. Cipolla, Fontana Economic History of Europe, Vols. II and III.
4. Carlo M. Cipolla, Before the Industrial Revolution, European Society and Economy, 1000 -1700. 3rd ed. (1993) .
5. D.C. Coleman (ed.), Revisions in Mercantilism.
6. Ralph Davis, The Rise of the Atlantic Economics.
7. Maurice Dobb, Studies in the Development of Capitalism.
8. J.R. Hale, Renaissance Europe.
9. R. Hall, From Galileo to Newton.
10. Christopher Hill, A Century of Revolutions.
11. Rodney Hilton, Transition from Feudalism to Capitalism.
12. H.G. Koenigsberger and G.L. Mosse, Europe in the Sixteenth Century.
13. Stephen J. Lee, Aspects of European History, 1494 – 1789.
14. G. Parker, Europe in Crisis, 1598 - 1648.
15. G. Parker and L.M. Smith, General Crisis of the Seventeenth Century.
16. J.H. Parry, The Age of Reconnaissance.
17. Meenaxi Phukan, Rise of the Modern West: Social and Economic History of Early Modern Europe.
18. Poliensiky, War and Society in Europe. 1618 -48.
19. Theodore K. Rabb, The Struggle for Stability in Early Modern Europe.
20. Scammell, The First Imperial Age: European Overseas Expansion, 1400-1715.
21. Jan de Vries, Economy of Europe in an Age of Crisis 1600 û 1750.

Semester IV

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: HIS 143

Course Title: HISTORY OF THE NAGAS (UPTO STATEHOOD)

UNIT I

The Nagas: Origin, migration, settlement, nomenclature, society language, economy, religion, and polity, village state, war and peace, Dormitory system, festivals, feast of merit.

UNIT II

Contact with Non-Nagas: Ahom – Naga Relations, First Anglo-Burmese War of 1826, Early British policy, Creation of the Naga Hills District, British Administration, Government of India Act 1935

UNIT III

Christianity in the State: Role of American Baptist Missionaries, spread of education, modernization and westernization and its effects

UNIT IV

Nationalism: The Naga Club, Simon Commission, Naga National Council, Akbar Hydari Agreement, Naga Plebiscite, Federal Government of Nagaland.

UNIT V

Statehood: The formation of the Naga People's Convention, the Sixteen Point Agreement and the birth of Nagaland State.

Suggested readings:

1. Alemchiba, M, A Brief Historical Account of Nagaland
2. Sema, Piketo, British Policy and Administration in the Naga Hills
3. Sema, Hokishe- Emergence of Nagaland
4. Mackenzie, Alexander- History of the Relations of the Government with the Hill tribes of North East frontier
5. Horam, M- Naga Polity
6. Hazarika, Sanjoy- Strangers in the Mist.
7. Hutton, J.H- The Angami Nagas
8. Hutton, J.H- The Sema Nagas
9. Mills, J.P- The Lotha Nagas
10. “ “- The Ao Nagas

Semester V

Course Code: HIS 151
Course Title: HISTORY OF INDIA (1750 - 1857) - V

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

1. India in the mid 18th Century; Society, Economy, Polity (18th century debate) Expansion and Consolidation of colonial Power:

- (a) Mercantilism, foreign trade and early forms of exactions from Bengal.
- (b) Dynamics of expansion, with special reference to Bengal, Mysore, Western India, Awadh, Punjab, and Sindh.

2. Colonial State and Ideology:

- (a) Arms of the colonial state: army, police, law.
- (b) Ideologies of the Raj and racial attitudes.
- (c) Education: indigenous and modern.

3. Rural Economy and Society:

- (a) Land revenue systems and forest policy.
- (b) Commercialization and indebtedness.
- (c) Rural society: change and continuity.
- (d) Famines.
- (e) Pastoral economy and shifting cultivation.

4. Trade and Industry

- [a] De industrialization
- [b] Trade and fiscal policy
- [c] Drain of Wealth
- [d] Growth of modern industry

5. Popular Resistance:

- (a) Santhal uprising (185-7); Indigo rebellion (1860); Pabna agrarian Leagues (1873); Deccan riots (1875).
- (b) Uprising of 1857

ESSENTIAL READINGS

1. C. A. Bayly, Indian Society and the Making of the British Empire, New Cambridge History of India.
2. Bipan Chandra, Rise and Growth of Economic Nationalism in India.
3. Suhash Chakravarty, The Raj Syndrome: A Study in Imperial Perceptions, 1989.
4. J.S. Grewal, The Sikhs of the Punjab, New Cambridge History of India
5. Ranajit Guha, ed., A Subaltern Studies Reader.
6. Dharma Kumar and Tapan Raychaudhuri, eds., The Cambridge Economic History of India, Vol. II.
7. P.J. Marshall, Bengal: The British Bridgehead, New Cambridge History of India.
8. R.C. Majumdar, ed., History and Culture of Indian People, Vols. IX and X. British Paramountcy and Indian Renaissance.
9. Rajat K. Ray, ed., Entrepreneurship and Industry in India, 1800- 1947, Oxford In India Readings.
10. Eric Stokes, English Utilitarians and India.

Semester V

Course Code: HIS 152
Course Title: History of Modern Europe (1780-1939) - I

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

I. The French Revolution:

Crisis of Ancien Regime [b] Intellectual currents. [c] Social classes and emerging gender relations. [d] Phases of the French Revolution 1789 - 99. [e] Art and Culture of French Revolution.

II. Napoleonic consolidation - reform and empire.

III. Restoration and Revolution: c. 1815 - 1848: [a] Forces of conservatism & restoration of old hierarchies. [b] Social, Political and intellectual currents. [c] Revolutionary and Radical movements, 1830 - 1848.

IV. Capitalist Industrialization and Social and Economic Transformation (Late 18th century to AD 1914) [a] Process of capitalist development in industry and agriculture: case Studies of Britain, France, the German States and Russia. [b] Evolution and Differentiation of social classes: Bourgeoisie, Proletariat, land owning classes and peasantry. [c] Changing trends in demography and urban patterns. [d] Family, gender and process of industrialization.

V. Varieties of Nationalism and the Remaking of States in the 19th and 20th Centuries. [a] Intellectual currents, popular movements and the formation of National identities in Germany, Italy, Ireland and the Balkans. [b] Specificities of economic development, political and administrative Reorganization - Italy; Germany.

ESSENTIAL READINGS

1. Gerald Brennan: The Spanish Labyrinth: An Account of the Social and Political Background of the Civil War.
2. C.M. Cipolla: Fontana Economic History of Europe, Volume III: The Industrial Revolution.
3. Norman Davies, Europe.
4. J. Evans: The Foundations of a Modern State in 19th Century Europe.
5. T.S. Hamerow: Restoration, Revolution and Reaction: Economics and Politics in Germany [1815 – 1871].
6. E.J. Hobsbawn: The Age of Revolution.
7. Lynn Hunt: Politics, Culture and Class in the French Revolution.
8. James Joll, Europe Since 1870.
9. David Landes: Prometheus Unbound.
10. George Lefebvre, Coming of the French Revolution.
11. George Lichtheim : A Short History of Socialism.
12. Peter Mathias, First Industrial Revolution.
13. Alec Nove: An Economic History of the USSR.
14. Andrew Porter, European Imperialism, 18760 û 1914 (1994).
15. Anthony Wood, History of Europe, 1815 û 1960 (1983).
16. Stuart Woolf: History of Italy, 1700 û 1860.

Semester VI

Course Code: HIS 161
Course Title: HISTORY OF INDIA (1857 - 1950) - VI

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

I. Cultures changes and Social and Religious Reform Movements:

- (a) The advent of printing and its implications
 [b] Reform and Revival: Brahmo Samaj, Prarthna Samaj, and Ramakrishna and Vivekananda, Arya Samaj, Wahabi, Deoband, Aligarh and Singh Sabha Movements. [c] Debates around gender . [d] Making of religious and linguistic identities [e] Caste: sanskritising and anti Brahminical trends

II. Nationalism: Trends up to 1919:

- (a) Political ideology and organizations, formation of INC . [b] Moderates and extremists. [c] Swadeshi movement . [d] Revolutionaries

III. Gandhian nationalism after 1919: Ideas and Movements:

- (a) Mahatma Gandhi: his Perspectives and Methods
 [b] (i) Impact of the First World War (ii) Rowlatt Satyagraha and Jallianwala Bagh (iii) Non- Cooperative and Civil Disobedience (iv) Provincial Autonomy, Quit India and INA . [c] Left wing movements
 [d] Princely India: States people movements . [e] Nationalism and Culture: literature and art

IV. Nationalism and Social Groups : Interfaces:

- [a] Landlords, Professionals and Middle Classes . [b] Peasants [c] Tribal [d] Labour [e] Dalits [f] Women
 [g] Business groups. **Communalism:** Ideologies and practices, RSS, Hindu Maha Sabha, Muslim League.

V. Independence and Partition

- [a] Negotiations for independence, and partition [b] Popular movements [c] Partition riots.

Emergence of a New State:

- (a) Making of the Constitution [b] Integration of princely states [c] Land reform and beginnings of planning

ESSENTIAL READINGS

- Judith Brown, Gandhi's rise to Power, 1915-22.
- Paul Brass, The Politics of India Since Independence, OUP, 1990.
- Bipan Chandra, Nationalism and Colonialism in Modern India, 1979.
- Bipan Chandra, Rise and Growth of Economic Nationalism in India.
- Mohandas K. Gandhi, An Autobiography or 'The Story of My Experiments with Truth. Ranajit Guha, ed., A Subaltern Studies Reader.
- Peter Hardy, Muslims of British India.
- Mushirul Hasan, ed., India's Partition, Oxford in India Readings. D.A. Low, ed., Congress and the Raj.
- John R. McLane, Indian Nationalism and the Early Congress.
- Jawaharlal Nehru, An Autobiography.
- Gyanendra Pandey, The Construction of Communalism in colonial north India.
- Sumit Sarkar, Modern India, 1885-1947.
- Anil Seal, Emergence of Indian Nationalism.
- Ram Lakhan Shukla (ed.), Adhunik Bharat ka Itihas. Eleanor Zelliot, From Untouchable to Dalit:

Semester VI

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: HIS 162

Course Title: HISTORY OF MODERN EUROPE(1780 - 1939) - II

I. Liberal Democracy, Working Class Movements and Socialism in the 19th and 20th Centuries: [a] The struggle for parliamentary democracy and civil liberties in Britain.

[b] Forms of protest during early capitalism: food riots in France and England: Luddites and Chartism.

[c] Early socialist thought; Marxian Socialism û the First and the Second International.

[d] German Social Democracy, Politics and Culture. [e] Christian Democracy as a political and ideological force in western and central Europe

II. The Crisis of Feudalism in Russia and Experiments in Socialism: [a] Emancipation of serfs.

[b] Russian Populism and Social Democracy. [c] Revolutions of 1905; the Bolshevik Revolution of 1917. [d] Programme of Socialist Construction.

III. Imperialism, War, and Crisis: Theories and mechanisms of imperialism; growth of Militarism; Power blocks and alliances: expansion of European empires - War of 1914 – 1918.

IV. The post 1919 World Order: economic crises, the Great Depression and Recovery. [c] Fascism and Nazism. [d] The Spanish Civil War. [e] Origins of the Second World War.

V. Cultural and Intellectual Developments since circa 1850: [a] Changing contexts: [i] Notions of Culture [ii] Creation of a New public sphere and mass media [iii] Mass education and extension of literacy. [b] Creation of new cultural forms: from Romanticism to Abstract Art. [c] Major intellectual trends: [i] Institutionalization of disciplines history Sociology and Anthropology. [ii] Darwin and Freud. [d] Culture and the making of ideologies: Constructions of Race, Class and Gender, ideologies of Empire.

ESSENTIAL READINGS

1. Gerald Brennan: The Spanish Labyrinth: An Account of the Social and Political Background of the Civil War
2. C.M. Cipolla: Fontana Economic History of Europe, Volume II the Present (1981). I : The Industrial Revolution.
3. Norman Davies, Europe.
4. J. Evans: The Foundations of a Modern State in 19th Century Europe.
5. T.S. Hamerow: Restoration, Revolution and Reaction: Economics and Politics in Germany [1815 - 1871].
6. E.J. Hobsbawn : The Age of Revolution. Lynn Hunt: Politics, Culture and Class in the French Revolution.
7. James Joll, Europe Since 1870.
8. David Landes: Prometheus Unbound. George Lefebvre, Coming of the French Revolution.
9. George Lichtheim: A Short History of Socialism.
10. Peter Mathias, First Industrial Revolution.
11. Alec Nove: An Economic History of the USSR.
12. Andrew Porter, European Imperialism, 18760 -1914 (1994).
13. Anthony Wood, History of Europe, 1815 û 1960 (1983).
14. Stuart Woolf: History of Italy, 1700 û 1860.

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSEC)

Semester V

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: HIS 251

Course Title: HISTORY OF THE UNITED STATES OF AMERICA (1776- 1865) - I

I. The Background:

The land and indigenous people: settlement and colonization by Europeans; early colonial society and politics; labor

Making of the Republic:

[a] Revolution Sources of conflict: Revolutionary groups, Ideology: The War of Independence and its historical interpretations

[b] Processes and Features of Constitution making:

II. Evolution of American Democracy: [a] Federalists: Jeffersonianism: Jacksonianism, Rise of political parties-1840-1960; judiciary-role of the Supreme Court

[b] Expansion of Frontier: Turner's Thesis; Marginalization, displacement and decimation of native Americans; Case histories of Tecumseh; Shawnee Prophet.

[c] Limits of democracy: Blacks and women.

III. Early Capitalism:

[a] Beginnings of Industrialization. [b] Immigrants and changing composition of Labour; Early Labour Movements.

IV. The Agrarian South: [a] Plantation economy. [b] Slave Society and Culture: Slave resistance.

V. Ante Bellum Foreign Policy: War of 1812: Monroe Doctrine: Manifest Destiny.

Civil War: [a] Abolitionism and Sectionalism. [b] Issues and interpretations, and [c] Rise of Republicanism, Emancipation and Lincoln

ESSENTIAL READINGS

1. Bernard Bailyn, The Great Republic.
2. Bernard Bailyn, The Ideological Origins of the American Revolution.
3. Charles Beard, An Economic Interpretation of the American Constitution.
4. Dee Brown, Bury My Heart at Wounded Knee, An Indian History of the American West.
5. Peter Carroll and David Noble, Free and Unfree: A New History of the United States. David B. Davis, The Problem of Slavery in the Age of Revolution.
6. U. Faulkner, American Economic History.
7. Robert Fogel, Railroads and American Economic Growth.
8. Eric Foner, America's Black Past.
9. John Hope Franklin, From Slavery to Freedom.
10. Gerald N. Grobb and George A. Billias, Interpretations of American History: Patterns and Perspectives, 2 Vols.
11. Richard Hofstadter, The Age of Reform, From Bryan to FDR Linda Kerber, Women's America: Refocusing the Past.
12. David M. Potter, The Impending Crisis.

13. W. Pratt, A History of the United states Foreign Policy.
14. James Randail, The Civil War and Reconstruction.
- 15 J. G. Randall and David Donald, The Civil War and Reconstruction.
16. Kenneth Stamp, The Peculiar Institution, Slavery in the Ante- bellum South.
- 17 Federick Jackson Turner, The Frontier in American History.
18. Robert Wiebe, The Search for Order.

Semester V

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: HIS 252

Course Title: HISTORY OF THE UNITED STATES OF AMERICA (1865- 1945) -II

I .Reconstructions: Political changes and agrarian transformation: [a] Conservative and Radical phases. [b] The New South: Participants and Reactions, Carpetbaggers; Scalawags, Blacks, Ku Klux Klan.

II. Industrial America:

Growth of Capitalism and Big Business. [b] Business cycles; Depression.

Resistance and Reform: [a] Labour movements and Unionization. [b] Agrarian crises and populism. Urban corruption and progressivism.

[c] New Deal.

III. U.S. Imperialism:

[a] Spanish-American War [b] Expansion in the Far East and Latin America [c] World War I and Fourteen Points [d] Isolationism [e] Americans in World War II.

IV. Afro-American Movements: Black Movements: Booker T. Washington, W.E.B. Dubois; NAACP and Marcus Garvey.

Women's Movements: [a] Rise of the Lowell Factory System [b] Abolitionists and Women's rights movement [c] Suffrage [d] Afro-American Women

V. Religious, Cultural and Intellectual Trends: [a] Religious movements; Early Revivalism; Puritans, Quakers; Mormons; Temperance. [b] Mass culture (circa 1900 - 1945) [c] Major literary trends (circa 1900 - 1945).

ESSENTIAL READINGS

Same as paper I

DISCIPLINE SPECIFIC ELECTIVE COURSE**Semester VI**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: HIS 261**Course Title: HISTORY OF MODERN EAST ASIA (1840-1949) - I**

I. Imperialism and China during the 19th century: Chinese feudalism: Gentry, bureaucracy and peasantry; the Confucian value system; Sinocentrism; the Canton commercial system.

II. The transformation of China into an informal colony; the Opium Wars; the Unequal Treaties; the scramble for concessions; Finance Imperialism; the Open Door policy.

III. Agrarian and Popular Movements: Taiping and Yi Ho Tuan. (d) Attempts at Self-Strengthening (Tzu-chiang): Reforms of 1860- 95; 1 898; and 1901-08.

IV. The Emergence of Nationalism in China

(a) The Revolution of 1911: Causes, nature and significance; the social composition of the Revolution; Sun Yat-sen and his contribution; the formation of the Republic; Yuan Shih Kai; Warlordism.

(b) May Fourth Movement of 1919: Nature and significance

V. RISE OF COMMUNISM

(i) Nationalism & Communism in China (1921-1937)

(a) Formation of CCP; and the Guomintang (National Party of KMT)

(b) The First United Front

(ii) The Communist Movement (1938-1949)

(iii) The Jiangxi Period and the rise of Mao Tse Tung

ESSENTIAL READINGS

- George Allen, A Short Economic History of Japan.
- Jean Chesneaux, et al, China from Opium War to 1911 Revolution.
- Jean Chesneaux, et al, China from the 1911 Revolution to Liberation.
- Tan Chung, Triton and Dragon: Studies on the Nineteenth Century China and Imperialisms.
- John K. Fairbank, et al., and East Asia: Modern Transformation
- Y. Immanuel Hsu, The Rise of Modern China.
- Chalmers A Johnson, Peasant Nationalism and Communist Power: The Emergence of Red China, 1937 - 1945.
- Nathaniel Peffer, The Far East: A Modern History.
- Victor Purcell, The Boxer Uprising: A Background Study.
- Kenneth B. Pyle, The Making of Modern Japan.
- Franz Schuramann and Orville Schell (eds.), China Readings, 2 Volumes (Imperial China, and Republican China).
- Benjamin I. Schwartz, Mao and the Rise of Chinese Communism.
- Hu Sheng, Imperialism and Chinese Politics.
- Chow Tse tung, The May Fourth Movement: Intellectual Revolution in Modern, China. Mao Tse tung's Selected Writings, National Book Agency, Calcutta.
- Mary C. Wright, China in Revolution: The First Phase, 1900 -1913.

Semester VI

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: HIS 262

Course Title: HISTORY OF MODERN EAST ASIA (1868-1949) - II

I. Emergence of Modern Japan

Transition from feudalism to capitalism: (a) Crisis of Tokugawa Bakuhau system (b) Meiji Restoration :Its nature and Significance (c) Political Reorganization (d) Military Reforms (e) Social, cultural and educational reforms (bunmeikaika) (f) Financial reforms and educational development in the 'Meiji'era (G) Meiji Constitution

II. Japanese Imperialism

- (a) China
- (b) Manchuria
- (c) Korea

III. Democracy and Militarism/Fascism in Japan

- (a) Popular/People' s Rights Movement
- (b) Nature of political parties
- (c) Rise of Militarism-Nature and significance
- (d) Second World War; American occupation
- (e) Post-War Changes

IV. Emergence of Modern Korea

- (a) The old order and Institutional Decay: Joseon Korea
- (b) Korea's interactions with the western powers and Korea's unequal treaties with Japan
- (c) Attempts at social, political and economic reforms in Korea

V. Japan's colonization of Korea: March First Movement and the growth of Korean nationalism; in situational transformation 1910-1945 Post-War Changes

ESSENTIAL READINGS

1. George Allen, A Short Economic History of Japan.
2. G. Beasley, The Modern History of Japan.
3. John K. Fairbank, et al., East Asia: Modern Transformation
4. Mikiso Hane, Modern Japan: A Historical Survey.
5. Y. Immanuel Hsu, The Rise of Modern China.
6. Jon Livingstone, et. al., The Japan Reader (Imperial Japan : 1800 û 1945), Vol. I E.H. Norman, Japan's
7. Emergence as a Modern State.
8. Nathaniel Peffer, The Far East: A Modern History.
9. Kenneth B. Pyle, The Making of Modern Japan.
10. Chow Tse Tung, The May Fourth Movement: Intellectual Revolution in Modern, China. 1913.
11. Michael J. Seth, A concise history of Modern Korea, Rowman and Littlefield, 2009

SUGGESTED READINGS

1. Nathaniel Peffer, The Far East: A Modern History.
2. Ann Arbor: University of Michigan Press, 1958.
3. Bruce Cummings, Korea's place in the Sun: Modern History, W.W. Norton and Co., 1992
4. Ramon H. Mayers and Mark R. Peattie(ed), The Japanese Colonial Empire, 1895-1945, Princeton: Princeton University Press, 1984

GENERIC ELECTIVE COURSE (GEC)**Semester I**

Course Code: HIS 311
Course Title: History of Ancient India

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

I. Sources & Interpretation. A broad survey of Palaeolithic, Mesolithic and Neolithic Cultures. Harappan Civilization ;Origin, Extent, dominant features &decline, Chalcolithic age.

II. The Vedic Period: Polity, Society, Economy and Religion, Iron age with reference to PGW &Megaliths.Territorial States and the rise of Magadha, Conditions for the rise of Mahajanpadas and the Causes of Magadha's success. Iranian andMacedonian Invasions, Alexander's Invasion and impact

III. Jainism and Buddhism: Causes, Doctrines, Spread, Decline and Contributions.Emergence and Growth of Mauryan Empire; State Administration,Economy,Ashoka's Dhamma,Art &Architecture

IV. The Satvahana Phase: Aspects of Political History, Material Culture, and Administration & Religion. The Sangam Age: Sangam Literature, The three Early Kingdoms. The age of Shakas, Parthians & Kushanas ;Aspects of Polity, Society,Religion, economy

V. The Rise & Growth of the Guptas: Administration, Society, Economy, Religion, Art, Literature, and Science &Technology. Harsha & His Times: Harsha's Kingdom, Administration, Buddhism & Nalanda

References:

1. Agrawal, D.P. The Archaeology of India
2. Basham, A.L. The Wonder That was India
3. Chakrabarti, D.K. Archaeology of Ancient Indian Cities
4. Jaiswal, Suvira Caste: Origin, Function and Dimensions
5. Subramanian, N. Sangam Polity
6. Thapar, Romila History of Early India
7. Allchin, F.R. and B Origins of a Civilization: The Prehistory and Early Archaeology of South Asia
8. Basham, A.L. The Wonder That was India
9. Jha, D.N. Ancient India in Historical Outline (1998 edn.)
10. Kosambi, D.D. Culture and Civilization of Ancient India
11. Ray, H.P. Monastery and Guild India in Historical Outline
12. Sastri, K.A.N. A History of South India
13. R.S Sharma, India's Ancient Past
14. Ray, Niharranjan Maurya and Post Maurya Art.
15. Sharma, R.S. Aspects of Political Ideas and Institutions in Ancient India (1991 edn.)
16. Thapar, Romila Ashoka and the Decline of the Mauryas (1997 edn)
17. Yazdani, G. Early History of Deccan

Semester II

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: HIS 321

Course Title: History of Medieval India

I. Towards the Early Medieval: Changes in Society, Polity Economy and Culture with reference to the Pallavas, Chalukayas and Vardhanas; Evolution of Political structures of Rashtakutas Palas & Pratiharas; Emergence of Rajput States in Northern India: Polity, Economy & Society. Arabs in Sindh: Polity, Religion & Society. Struggle for power in Northern India & establishment of Sultanate.

II. Foundation, Expansion & consolidation of the Delhi Sultanate; Nobility & Iqta system. Military, administrative & economic reforms under the Khiljis & the Tughlaqs. Bhakti & Sufi Movements.

III. Provincial kingdoms: a) Mewar, Bengal, Vijaynagara & Bahamanis. b) Second Afghan State.

IV. Emergence and consolidation of Mughal State: C. 16th century to mid 17th century.

V. Akbar to Aurangzeb: administrative structure-Mansab & Jagirs, State & Religion, Socio-Religious Movements. Economy, Society & Culture under the Mughals. Emergence of Maratha Power.

References:

1. R. S. Sharma: Indian Feudalism-India's Ancient Past
2. B. D. Chattopadhyaya: Making of Early Medieval India
3. Derryl N. Maclean: Religion and Society in Arab Sindh
4. K. M. Ashraf: Life and Conditions of the People of Hindustan
5. M. Habib and K.A. Nizami: A Comprehensive History of India Vol.V
6. Tapan Ray Chaudhary and Irfan Habib (ed.)
7. The Cambridge Economic History of India, Vol.I
8. Peter Jackson: Delhi Sultanate: A Political and Military History
9. Tara Chand: Influence of Islam on Indian Culture
10. Satish Chandra: A History of Medieval India, 2 Volumes
11. Percy Brown, : Islamic Architecture
12. Irfan Habib: The Agrarian System of Mughal India 1556-1707,
13. M. Athar Ali: Mughal Nobility under Aurangzeb,
14. Shireen Moosvi: The Economy of the Mughal Empire
15. S.A.A. Rizvi: Muslim Revivalist Movements in Northern India during 16th and 17th Centuries
16. R.P. Tripathi: The Rise and Fall of the Mughal Empire, 2 vol.
17. I. H. Siddiqui: Some Aspects of Afghan Despotism
18. Kesvan Veluthat: Political Structure of Early Medieval South India
19. P.J. Marshall: The Eighteenth Century in Indian History.
20. Stewart Gordon, : The Marathas 1600-1818

Semester III

Course Code: HIS 331
Course Title: History of Modern India

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

I. Interpreting the 18th Century. Emergence of Independent States & establishment of Colonial power.

II. Expansion & consolidation of Colonial Power upto 1857. Uprising of 1857: Causes, Nature & Aftermath.

III. Colonial economy: Agriculture, Trade & Industry. Socio-Religious Movements in the 19th century.

IV. Emergence & Growth of Nationalism with focus on Gandhian nationalism.

V. Communalism: Genesis, Growth and partition of India. Advent of Freedom: Constituent Assembly, establishment of Republic.

References:

1. Sugata Bose and Ayesha Jalal: Modern South Asia: History, Culture, Political Economy, New Delhi, 1998
2. Sekhar Bandyopadhyay From Plassey to Partition
3. Barbara D Metcalf and T.R. Metcalf A Concise History of India, Cambridge, 2002
4. C.A. Bayly: An Illustrated History of Modern India 1600 - 1947, London 1990
5. Sumit Sarkar Modern India 1885 ñ 1947, Mamillan, 1983
6. Mushirul Hasan John Company to the Republic: A story of Modern India
7. R.P. Dutt, India Today.
8. Thomas Metcalf Ideologies of the Raj.
9. R. Jeffery, J Masseloss, From Rebellion to the Republic.
10. Bipan Chandra: Nationalism and Colonialism.
11. Bipan Chandra, Aditya Mukherjee, India After Independence,

Semester IV

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: HIS 341

Course Title: HISTORY OF THE NAGAS (Upto Statehood)

UNIT I

The Nagas: Origin, migration, settlement, nomenclature, society language, economy, religion, and polity; village state, war and peace, Dormitory system, festivals, feast of merit.

UNIT II

Contact with Non-Nagas: Ahom – Naga Relations, First Anglo-Burmese War of 1826, Early British policy, Creation of the Naga Hills District, British Administration, Government of India Act 1935

UNIT III

Christianity in the State: Role of American Baptist Missionaries, spread of education, modernization and westernization and its effects

UNIT IV

Nationalism: The Naga Club, Simon Commission, Naga National Council, Akbar Hydari Agreement, Naga Plebiscite, Federal Government of Nagaland.

UNIT V

Statehood: The formation of the Naga People's Convention, the Sixteen Point Agreement and the birth of Nagaland State.

Suggested readings:

1. Alemchiba, M, A Brief Historical Account of Nagaland
2. Sema, Piketo, British Policy and Administration in the Naga Hills
3. Sema, Hokishe- Emergence of Nagaland
4. Mackenzie, Alexander- History of the Relations of the Government with the Hill tribes of North
5. East frontier
6. Horam, M- Naga Polity
7. Hazarika, Sanjoy- Strangers in the Mist.
8. Hutton, J.H- The Angami Nagas
9. Hutton, J.H- The Sema Nagas
10. Mills, J.P- The Lotha Nagas
11. “ “- The Ao Nagas

SKILL ENHANCEMENT COURSE (SEC)**Semester III**

Course Code: HIS 531
Course Title: Understanding Heritage

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

This course will enable students to understand the different facets of heritage and their significance. It highlights the legal and institutional frameworks for heritage protection in India as also the challenges facing it. The implications of the rapidly changing interface between heritage and history will also be examined. The course will be strongly project-based and will require visits to sites and monuments. At least two Projects will be based on visits to Museums/Heritage Sites.

I. Defining Heritage

Meaning of 'antiquity', 'archaeological site', 'tangible heritage', 'intangible heritage' and 'art treasure' Evolution of Heritage Legislation and the Institutional Framework: Conventions and Acts— national and international Heritage-related government departments, museums, regulatory bodies etc. Conservation Initiatives

II. Challenges facing Tangible and Intangible Heritage Development, antiquity smuggling, conflict (to be examined through specific case studies)

III. Heritage and Travel:

Viewing Heritage Sites; The relationship between cultural heritage, landscape and travel recent trends

Essential Readings

1. David Lowenthal, Possessed By The Past: The Heritage Crusade and The Spoils of History, Cambridge, 2010
2. Layton, R. P. Stone and J. Thomas. Destruction and Conservation of Cultural Property. London: Rutledge, 2001
3. Lahiri, N. Marshaling the Past - Ancient India and its Modern Histories. Ranikhet: Permanent Black. 2012, Chapters 4 and 5.
4. S.S. Biswas, Protecting the Cultural Heritage (National Legislations and International Conventions). New Delhi: INTACH, 1999.

Semester IV

Course Code: HIS 541
Course Title: Archives and Museums

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

This course introduces students to the institutions that house and maintain documentary, visual and material remains of the past. Museums and archives are among the most important such repositories and this course explains their significance and how they work. Students will be encouraged to undertake collection, documentation and exhibition of such materials in their localities and colleges. Visit to National Archives and National Museum are an integral part of the course.

I. Definition and history of development (with special reference to India) Types of archives and museums; Understanding the traditions of preservation in India Collection policies, ethics and procedures
Collection: field exploration, excavation, purchase, gift and bequests, loans and deposits, exchanges, treasure trove confiscation and others

II. Documentation: accessioning, indexing, cataloguing, digital documentation and de-accessioning.
Preservation: curatorial care, preventive conservation, chemical preservation and restoration

III. Museum Presentation and Exhibition: Museums, Archives and Society: (Education and communication Outreach activities

Essential Readings:

1. Saloni Mathur, *India By Design: Colonial History and Cultural Display*, University of California, 2007
2. Sengupta, S. *Experiencing History Through Archives*. Delhi: Munshiram Manoharlal. 2004.
3. Guha, Thakurta, Tapati, *Monuments, Objects, Histories: Institution of Art in Colonial*
4. *Colonial India*, New York, 2004 Kathpalia, Y. P. *Conservation and Restoration of Archive Materials*. UNESCO, 1973
5. Choudhary, R.D. *Museums of India and their maladies*. Calcutta: Agam Kala. 1988
6. Nair, S.M. *Bio-Deterioration of Museum Materials*. 2011
7. Agrawal, O.P., *Essentials of Conservation and Museology*, Delhi, 20

PHILOSOPHY HONOURS

| Semester | Core Course | Ability En- hancement Course | Skill En- hancement Course | Discipline Specific Elec- tive Course | Generic Elec- tive Course |
|--|---|------------------------------------|------------------------------------|---|---|
| First | Epistemology & metaphysics (6) | Environmental Studies (2) | | | Epistemology & metaphysics (6) |
| | Indian Philosophy: I (6) | | | | |
| Second | Philosophical concepts: Indian & western (6) | English Communication (2) | | | Philosophical concepts: Indian & west- ern (6) |
| | Indian Philosophy: II (6) | | | | |
| Third | Ethics (6) | | Logic (2) | | Ethics (6) |
| | History of western Philosophy (6) | | | | |
| | Philosophy of religion (6) | | | | |
| Fourth | Ethics (Indian & Applied) (6) | | Environmental Philosophy (2) | | Social & Political Philosophy (6) |
| | Social & Political Philosophy: I (6) | | | | |
| | Philosophy of Mahatma Gandhi (6) | | | | |
| Fifth | Philosophy of culture (6) | | | Comparative Religion (6) | |
| | Philosophy of Mind (6) | | | Philosophy of Human Rights (6) | |
| Sixth | Social & Political Philosophy: II (6) | | | Philosophy & Theology (6) | |
| | Project work (6) | | | Symbolic Logic (6) | |
| No. of Courses (Credit) | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |

CORE COURSE (CC)**Semester I**

Course Code: PHI 111
Course Title: Epistemology and Metaphysics

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I

1. Meaning of Philosophy, nature and scope, branches of Philosophy
2. Relationship of Philosophy to science and religion

Unit II.

Sources of knowledge: Rationalism, Empiricism

Unit III.

Theories of Perception: Realism
 Naive Realism
 Critical Realism Idealism
 Subjective Idealism
 Objective Idealism

Unit IV

Theories of Truth (Correspondence, Coherence, Pragmatic and Self-Evident)

Unit V

Categories of knowledge:
 Substance,
 Causality (Aristotle and Hume) and Space-time

Suggested Readings:

1. Hospers, J *An Introduction to Philosophical analysis*, Allied Publishers, Delhi
2. Hamlyn, D.W *Metaphysics*, Cambridge University Press
3. Feibleman, J.K *Understanding Philosophy*, Jaico Publishing House, Mumbai
4. Russell, B *Problems of Philosophy*, Oxford University press
5. Bhattacharjee, H.M *Principles of Philosophy*
6. J.Sinha, *Introduction to Philosophy*
7. J.Sanyal, *Guide to philosophy*

Semester I

Course Code: PHI 112
Course Title: Indian Philosophy: I

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

Indian Philosophy: Common characteristic, Classification of the school of Indian Philosophy

Unit II:

Nyāya Sources of knowledge: perception (pratyakṣa), inference (anumāna), comparison (upamāna) and word/testimony of reliable sources (śabda).

Unit III:

Mīmāṃsā: Anupalabdhi and Arthāpatti

Unit IV:

Cārvāka: Metaphysics and Epistemology

Unit V:

Yoga: Eight fold method

Suggested readings:

1. Chatterjee, S & Datta *An Introduction to Indian Philosophy*, Calcutta University
2. Hiriyana, M *Outlines of Indian Philosophy*, George Allen & Unwin, London
3. Sharma, C.D *Critical Survey of Indian Philosophy*, Motilal Banarsidass, Delhi
4. Radhakrishnan, S *Indian Philosophy, Vol. I & II*, George Allen & Unwin, London
5. Mahadevan, T.M.P *Invitation to Indian Philosophy*, Arnold-Heinemann Publications, New Delhi
7. Mukherjee, S *The Buddhist philosophy of Flux*
8. J.Sinha, *Outlines of Indian Philosophy*, New central book agency, Guwahati.
9. J.Sanyal, *Guide to Indian Philosophy*
10. Dasgupta, S.N. (2004), *A History of Indian Philosophy*, vol.1, Delhi, Motilal Banarasidass Publishers, Pvt. Ltd.

Semester II

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: PHI 121

Course Title: Philosophical concepts: Indian and Western

Unit I

Nature, characteristics and schools of Indian Philosophy

Unit II

Prama: Svataha-pramany-vada

Vedanta

Mimamsa

Sankhya

Paraatha-pramanya-vada

Nyaya

Unit III

Indian theory of Causation: Satkaryavada and Asatkaryavada

Unit IV

1. Theory of evolution: Darwin and Lamarck

2. Sāṃkhya: Prakṛti and Puruṣa, Theory of Evolution

Unit V

God and the world: Deism, Pantheism, Panentheism / Theism

Suggested readings:

1. Ewing, A.C Fundamental Questions of Philosophy
2. Chatterjee, S & Datta, D An Introduction to Indian Philosophy
3. Titus, H.H Living issues in Philosophy, Eurasia Publishing House, New Delhi
4. Hiriyanna, M Outlines of Indian Philosophy
5. Sinha, J.N Introduction to Philosophy, Central Book Agencies, Calcutta

Semester II

Course Code: PHI 122
Course Title: Indian Philosophy: II

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I

Buddhism: four noble truth, eight foldpath, theory of Anityavada and Pratīyasamutpāda

Unit II

Jainism: *Anekāntavāda* and *Syādvāda*

Unit III

1. Sāṃkhya: *Prakṛti* and *Puruṣa*, Theory of Evolution, *Asatkāryavāda* and *Satkāryavāda* Debate
 2. Vaisesika: Categories

Unit IV

Advaita Vedānta of Śamkara: Nature of *Brahman* and *Māyā*

Unit V

Viśiṣṭādvaita of Rāmānuja: Nature of Brahman and Refutation of *Māyā*

Suggested readings:

1. Chatterjee, S & Datta An Introduction to Indian Philosophy, Calcutta University
2. Hiriyana, M Outlins of Indian Philosophy, George Allen & Unwin, London
3. Sharma, C.D Critical Survey of Indian Philosophy, Motilal Banarsidass, Delhi
4. Radhakrishnan, S Indian Philosophy, Vol. I & II, George Allen & Unwin, London
5. Mahadevan, T.M.P Invitation to Indian Philosophy, Arnold-Heinemann Publications, New Delhi
7. Mukherjee, S The Buddhist philosophy of Flux
8. J.Sinha, Outlines of Indian Philosophy, New central book agency, Guwahati.
9. J.Sanyal, Guide to Indian Philosophy
10. Dasgupta, S.N. (2004), *A History of Indian Philosophy*, vol.1, Delhi, Motilal Banarasidass Publishers, Pvt. Ltd.
11. P.Bhola, Indian Philosophy, Laxmi NarainASgarwal, 2011

Semester III

Course Code: PHI 131
Course Title: Ethics

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I

Ethics: Nature, scope and relation to religion and politics.
 Nature of Morality and Moral Philosophy.

Unit II

Nature of Moral Judgment

Unit III

1. Freedom and social responsibility
2. 2. Concept of Good, right and Virtue

Unit IV

Hedonism: J.S.Mill and Bentham

Unit V

Rigorism: Immanuel Kant

Suggested readings:

1. Lillie, W *Introduction to Ethics*, Allied Publishers, Delhi
2. Frankena, W *Ethics*, Prentice Hall of India, New Delhi
3. Mobbot *Introduction to Ethics*, Hutchington, London
4. Warnock, M *Ethics since 1900*, Oxford University Press
5. Velasquez, M(ed) & Arras, J(ed) *Ethics*, Prentice Hall
6. Padhi, N.C & Panigrabi, S.C *Basic Principles of Ethics*, Santosh Publications
7. Mackenzie *A manual of Ethics*
8. Dr.R.K.Bebera, *Moral Philosophy (A book with a difference)*
9. J.Sinha, *A manual of Ethics*, New central Book agency(p) ltd, Guwahati-7810001 -7810001

Semester III

Course Code: PHI 132
Course Title: History of Western Philosophy

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

Greek Philosophy
 Plato: Forms and knowledge
 Aristotle: metaphysics, theory of causation

Unit II:

Rationalism
 Descartes: Substance, Cogito ergo sum
 Spinoza: Substance, attributes and modes
 Leibnitz: Monadology

Unit III:

Empiricism
 Locke: Primary and secondary qualities
 Berkeley: Esse est Percipi
 Hume: Theory of Causation

Unit IV:

Critical Philosophy
 Kant: Space and time, synthetic a-priori judgment

Suggested readings:

1. Burnet History of Greek Philosophy, Macmillan
2. Stace, W.T Critical History of Greek Philosophy, Macmillan
3. Falckenberg, R History of modern Philosophy, Progressive publishers, Calcutta
4. Thilly, F History of Philosophy, Central Publishing House, Allahabad
5. Russel, B History of Western Philosophy, George Allen & Unwin, London
6. Dr.I.Sengupta, A short history of western Philosophy, New central Book agency(p)Ltd, Guwahti
7. P.Bhola, Western Philosophy, Laxmi NarainASgarwal, 2011

Semester III

Course Code: PHI 133
Course Title: Philosophy of Religion

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

1. Concept of religion: Problem & Origin
2. Foundation of religious belief: Reason & Revelation

Unit II:

Arguments for the proof of the existence of God.
 Cosmological Argument
 Ontological Argument
 Teleological Argument

Unit III

The idea of God: Christianity, Hinduism, Islam and Buddhism

Unit IV

Concept of God among the Naga tribe

Unit V

Religious pluralism: Religious diversity, inter-religious dialogue

Suggested readings:

1. Hick, J *Philosophy of Religion*, Prentice Hall
2. Hick, J(ed) *Classical and Contemporary readings in philosophy of religion*.
3. Paniker, R *Inter-religious dialogue*, Paulish Press, New York
4. Radhakrishnan, S *Eastern religion & Western thought*
5. Bebera, R.K *The philosophical concept of God*, Akansha Publishing House, New Delhi
6. Miri, (ed) *Rationality and tribal thought*, Mittal publication
7. Longford, T.A(ed) *Philosophy of religion*, Macmillan, New York
8. *Encyclopedia of Religion and Ethics*, T & T Clark, 6th Impression, 1967
9. Masih, Y *A Comparative study of Religions*, Motilal Banarsidass Publications
10. D.M.Edward *Philosophy of religion*
11. R.K.Bebera, *Philosophical concept of God*, Akankhya publishing House, New Delhi.
12. Dr.HitocaAchumi, *Beliefs and practices of the Nagas with special reference to Sumi Naga*, Gauhati University

Semester IV

Course Code: PHI 141
Course Title: Ethics (Indian & Applied)

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

1. Four *Puruṣārthas*: *Dharma*, *Artha*, *Kāma*, *Mokṣa*
2. Varnāśrama Dharma

Unit II:

Bhagvadgītā: *Niṣkāmakarma*

Unit III:

1. Buddhist ethics: PanchaShila (five moral precepts)
2. **Jaina ethics: The Three Jewels (*The Ratna*)** Right faith - SamyakDarśana, Right knowledge - SamyakJñāna, Right conduct - SamyakCāritra

Unit IV:

1. Definition and Nature of Applied Ethics
2. Bio-ethics: Abortion, Cloning, Euthanasia, Suicide

Unit V:

Theories of Punishment (Retributive, Deterrent, Preventive, Reformatory)

Suggested readings:

1. Peter Singer Applied Ethics, Oxford University Press
2. Frankena, W Ethics, Prentice Hall of India, New Delhi
3. Mobbott Introduction to Ethics, Hutchinson, London
4. Hiriyana, M The Indian Concept of Values
5. Kotturan, G Ahimsa from Gautam to Gandhi, Sterling, New Delhi
6. Hunt, R(ed) Ethical issues in modern medicine, Mayfield publishing com., California, 1977
7. V.MardR.Cyntha Ethical theory and practice, Prentice Hall, New Jersey
8. Dr.R.K.Behera, Moral Philosophy (A book with a difference)

Semester IV

Course Code: PHI 142
Course Title: Social and Political Philosophy: I

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

Nature and scope of social and political philosophy and its relation to sociology and social psychology.

Unit II:

Individual, state and Nation

Unit III:

Social ideals: Liberty, equality and social justice

Unit IV:

The concept of social contract

Unit V:

Method of political action: Revolution, terrorism and Satyagraha

Suggested readings:

1. Raphael, D.D *Problems of Political philosophy*, Macmillan, London
2. Quidon, A(ed) *Political philosophy*, Oxford University Press, London.
3. Russell, B *Authority & Individual*, George Allen & Unwin, London
4. Chattopadhyaya, D.P *Societies and culture*, Bharatia Vindhya Bhavan, Mumbai
5. Mabbhoff *The state and the citizen*
6. Joshi, N.V *Social and Political philosophy*
7. Gandhi, M.K *Hind Swaraj*, Navajivan Publishing House
8. Mashurwalla *Gandhi and Marx*

Semester IV

Course Code: PHI 143
Course Title: Philosophy of Mahatma Gandhi

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

1. Life of Mahatma Gandhi,
2. Philosophical Anthropology: Concept of Human Nature and Human Perfectibility

Unit II:

Social and Political thought: Swaraj, Swadeshi, Satyagraha, Sarvodaya, as a creed and Policy.

Unit III:

1. Religion and Politics
2. Truth in politics and society

Unit IV:

1. Gandhism and Marxism.
2. Rights of minorities

Unit V:

Gandhi's contribution to peace, Ahimsa as a creed and Policy.

Suggested Readings:

1. Iyer, Raghavan (ed.), *The Essential Writings of Mahatma Gandhi*, Oxford Univ. Press, India 1991. (Relevant Portions).
2. Iyer, Raghavan, *The Moral and Political Thought of Mahatma Gandhi*, Oxford Univ. Press India, (relevant portions)
3. Datta, D.M., *The Philosophy of Mahatma Gandhi*, Calcutta University.
4. Dalton, Dennis, *Power of Gandhi: Non-Violence in Action*
5. Pieterse, Jan Nederveen & Parekh Bhikhu *The Decolonization of Imagination*
6. Partha Chatterjee, *Nationalist Thought and the Colonial World*, Oxford Univ. Press
7. Parel, Anthony J. (ed) (2009), *'Hind Swaraj' and Other Writings*, Cambridge University Press

Semester V

Course Code: PHI 151
Course Title: Philosophy of Culture

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit 1:

Concept of culture: Nature and culture, cultural identity, tradition

Unit II:

Theories of culture: structuralism and functionalism,

Unit III:

Naga Culture: brief history of the origin and settlement

Unit IV:

Naga traditional belief: system of worship, ceremonies and sacrifices.

Unit V:

Naga Festivals, traditional government

Suggested readings:

1. Tribal Philosophy and Culture: Mao Naga of North-East by Athikho Kaisii & Heni Francis Ariina (eds.) Mittal Publications (2012)
2. R.R. Shimray: Origin and culture of Nagas
3. M. Horam, Socio cultural life of Nagas
4. Dr. Tuisem A. Shishak, Indigenous Naga culture (Nagas and education)
5. Dr. Gautam Chatterjee, Glimpses of Naga life and culture
6. J.P. Mills, ICS, Certain aspect of Naga Culture
7. Dr. Hitoca Achumi, *Beliefs and practices of the Nagas with special reference to Sumi Naga*, Gauhati University
8. Philip Smith, Cultural theory, Blackwell publishers, oxford, 2001
9. Levi-strauss, C, Structural anthropology, Basis books Paul, 1970
10. Terry Eagleton, The idea of culture, Blackwell, oxford, 2001
11. G.C. Pande, The meaning and process of culture, Shivallal Agarwal & company, Agra, 1972
12. Fred Inglis, Cultural studies, Blackwell publishers, Oxford, 1994

Semester V

Course Code: PHI 152
Course Title: Philosophy of Mind

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

Philosophy of mind and psychology

Unit II:

Chief Theories of mind: Cartesian dualism, Behaviorism and Artificial Intelligence.

Unit III:

The concept of self-knowledge and privacy, Concept of dream: Freudian

Unit IV:

Concept of Manas: Naya, Vaishesika and Sankhya

Unit V:

Mandukya Upanishad: Four states of Consciousness (Jagriti, svapna, susupti and turiya.)

Suggested readings:

1. Shaffer, J Philosophy of Mind, Eaglewood cliffs, Prentice Hall, 1968
2. Chapell, V.C(ed) The philosophy of mind, Prentice Hall
3. Burwood, S Philosophy of mind, ULC press
4. Hookway, C & Peterson, D Philosophy and cognitive science, Cambridge University press
5. Blackmore, C& Greenfield, S(ed) Mind waves, Basil Blackwell
6. Alexander, C.P Hidden Fragments of psychoanalysis, Omsons, New Delhi
7. Mac Intyre The Unconscious, Routledge and Kegan Paul
8. Ryle, G Concept of mind, Pengin Books
10. Hariyana, M Outline of Indian Philosophy, George Allen & Unwin
11. Churchland, P.,(1988) *Matter and Consciousness: A Contemporary Introduction to the Philosophy of Mind*, USA, MIT Press,
12. Crane, T.(2003), *The Mechanical Mind: A Philosophical Introduction to Minds, Machines and Mental Representation*,(2nd edition), , New York Routledge
13. David J. Chalmers(ed.) (2002), *Philosophy of Mind: Classical and Contemporary Readings*, Oxford, Oxford University Press
14. Heil, J.(2012), *Philosophy of Mind: A Contemporary Introduction* (3rd edition), London,
15. Kim, J.(2010), *Philosophy of Mind*, (3rd edition), USA, Westview Press

Semester VI

Course Code: PHI 161
Course Title: Social and Political Philosophy - II

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

Democracy, Socialism

Unit II:

Sarvodaya, Corruption and Public morality

Unit III

1. National integration
2. Secularism

Unit IV:

Humanism and Gender issues

Unit V:

Social development and ideas: Meaning and laws

Suggested readings:

1. *Raphel, D.D Problems of political philosophy, Macmillan, London*
2. *Quinton, A(ed) Political philosophy, Oxford University press, London*
3. *Russell, B Authority & individual, George allen&unwin, London*
4. *Chattopadhyaya, D.P- Societies and culture, Bharatia Vindhya Bhanvan, Mumbai*
5. *MobbffThe state and the citizen*
6. *Josbi, N.V Social and political philosophy*
7. *Gandhi, M.K Hindi Swaraj, Navajivan publishing house, Ahmedabad*
8. *Marshurwalla Gandhi and Marx*
9. *J.Sanyal: Guide to social philosophy, Sribbumi Publishing company, Calcutta*

Semester VI

Course Code: PHI 162
Course Title: Symbolic Logic

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

Introduction to symbolic logic

- (a) Definition and characteristics of Symbolic logic, material implication, Origin of symbolic logic
 (b) B. Symbols: variables and logical constants, utility of use of symbols

Unit II:

Traditional and Modern Concept of Proposition, Modern Classification of Proposition

Unit III:

Truth Function, Truth Table, Truth Table Method of Proving Validity and Invalidity

Unit IV:

Symbolization of statements, Symbolization of Compound Propositions, Symbolization of Singular-propositions and Traditional Propositions (A, E, I, O)

Unit V:

Informal Fallacies (as given in Irving Copi 14th edition)

Recommended books:

1. Patrick Suppes: Introduction to Logic, Affiliated East-West press private Ltd., New Delhi
2. A.H.Basson, D.J.O'Connor: Introduction to Symbolic Logic, Oxford University Press,
3. A.Ambrose, M.Lazerowiz: Fundamentals of Symbolic Logic, new York
4. H.Reichenbach: Elements of symbolic logic, new York
5. P.F.Strawson: Introduction to Logical theory, London
6. B.A.W.Russell: Introduction to Mathematical Philosophy. London
7. A.C.Stebbing: Introduction to Modern Logic, S.A.Publishing house, Calcutta
8. F.B.Fitch: Symbolic Logic, New York
9. Irving Copi: Introduction to Logic and symbolic Logic, Macmillan company.
10. Introduction to Logic by Irving M. Copi (14th Edition) Prentice Hall of India
11. Cohen & Nagel: Introduction to Logic and Scientific Method.
12. Symbolic logic by Irving m. Copi (fifth/sixth edition) prentice hall of India (chapter I – chapter v)

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSEC)**Semester V**

Course Code: PHI 251
Course Title: Comparative Religion

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

Hinduism: Hindu idea of god, life after death, ultimate human destiny

Unit II:

Buddhism: man, evil and suffering, life after death

Unit III:

Islam: basic features, God, world, man

Unit IV:

Sikhism: Basic features of Sikhism as a religion, life after death, ultimate human destiny.

Unit V:

Christianity: The idea of God in Christianity, life after death, salvation

Suggested readings

1. A.C. Boquet, comparative religion, penguin books, 1971
2. M. Eliade, comparative religion
3. Bhagavan Das, essential unit of religion
4. James Hastings (ed), Encyclopaedia of religion and ethic (relevant chapters)
5. Chatterjee, P.B, comparative religion
6. Srivastava, R.A, comparative religion
7. Tiwari, K.N, comparative religion
8. Lesser, W.A, Reader in comparative religion
9. Devaraja, N.K, Hinduism and Christianity

Semester V

Course Code: PHI 252
Course Title: Philosophy of Human Rights

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I :
 The Concept of Human Right, Human Rights in Indian Context

Unit II:
 Theories of Human Rights

Unit III:
 UN Declarations and Covenants, human rights of women, children

Unit IV:
 Human Rights and issues, Fundamentalism, Terrorism, Gender, Minorities and Human Rights.

Unit V:
 Rights of the Disabled-Issues and Theories

Suggested Readings:

1. Micheline R. Ishay (Ed.), *The Human Rights Reader*, Routledge, New York, 1997
2. David Boucher and Paul Kelley (Eds.), *The Social Contract from Hobbes to Rawls*, Routledge, London, 1994.
3. Eugene Kamenka and Alice Erh-Soon Tay (Eds.), *Human Rights*, Edward Arnold Pub. Ltd., London, 1993.
4. Jeremy Waldron, *Liberal Rights*, Cambridge University Press, Cambridge, 1993.
5. Johan Galtung, *Human Rights in another Key*, Polity Press, Cambridge, 1994.
6. Mathew H. Kramer, *Debate over Rights: Philosophical Enquiries*, Clarendon Press, Oxford, 1998.
7. C.J. Nirmal, *Human Rights in India*, Oxford University Press, Oxford, 2000.
8. N. Jayapalan, *Women and Human Rights*, Atlantic Publishers, New Delhi, 2001.
9. B.P. Singh Sehgal, *Human Rights in India: Problems and Perspectives*, Deep and Deep Pub., New Delhi, 1995.
10. M.A. Khan, *Human Rights and the Dalits*, Uppal Pub. House, New Delhi, 1995.
11. P.C. Mehra, *Tribal Rights*, Shiva Publishers, Udaipur, 1996.
12. Lennard I Davis (eds.), *The Disability Studies Reader*, Routledge, London, 1997.
13. Satish Chandra, *International Documents on Human Rights*, Mittal Publications, New Delhi, 1990.

Semester VI

Course Code: PHI 261
Course Title: Philosophy and Theology

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I :

1. Relation between Theology and Philosophy
2. The Problem of Evil
 - A. Two forms of argument
 - B. Responses and theodicies

Unit II:

Religious Pluralism and Christianity

Unit III:

Religion and Morality

- A. Definitions of Religion and Morality
- B. Relation

Unit IV:

Immortality of the Soul, Religious Tolerance

Unit V:

Faith and Reason

- A. The Problem
- B. Four basic modes of interaction
- C. Two views of faith and reason

Suggested Readings:

1. C.S.Lewis, The problem of Pain
2. James F.Ross, Philosophical Theology, The Bobbs-merrill Company, INC, 1967
3. Alvin Plantinga & Nicolas Walterstorff, Faith and Rationality
4. Colin Brown, Philosophy and Christian Faith, Tyndale Press, 1968
5. Emil Wilm, Studies in Philosophy and Theology, Leopold Class Library, 2015
6. Yung Warren, A Christian Approach to Philosophy, Baker Book House, 1954
7. J.I.Packer, Concise theology, Tyndale House Publishers, Inc, 1993
8. Y.Mashi, Introduction to religious Philosophy, motilalbanarsidass publishers private limited, Delhi
9. J Macquarrie, *Principles of Christian Thought (London: SCM Press)*
10. John Hick: Evil and the God of Love, Macmillan revised edition, 2007,
11. Keith Ward, Rational Theology and the Creativity of God
12. Kenneth Surin, *Theology and the Problem of Evil.*
13. Richard Swinburne, *Faith and Reason*
14. John H.Hick, *Philosophy of religion, Prentice Hall of India 1993*

Semester VI

Course Code: PHI 262
Course Title: Project work

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objectives:

This course aims to train the students in familiarizing the methods and techniques of art of writing philosophy on the selected topics/themes.

Guidelines: Project-work in philosophy will be "topics-based" in essay style. Instead of working through the history of philosophy focusing on great historical figures and their views on different topics; focus will be on great philosophical topics and look at what historical and contemporary writers have said about them. Any topic/theme of philosophical concern may be addressed.

The course in charge will give detailed instructions keeping in view that every student learns the fundamentals of doing philosophical writings/practical works. Finalization of topic should be done well in advance and presentation of project work should be completed within the stipulated period fixed by the Department/Course in charge. Start early, be specific, employ a dissertation, use only what is necessary, examples may be used where needed, discuss counter-arguments, be original, strive for clarity, conclusion should be consistent with introduction. Add foot notes and references in support of your discussion/dissertation.

Example of a well organized piece of writing: a. Introduction and statement of thesis b. filling in background, clarifying terminology, spelling out others' views, arguments c. developing own position and arguments d. refuting counter-arguments and conclusion. Dissertation should be submitted to the Course in charge/instructors well typed in double space in A/4 size paper in 12 point font and minimum number of pages will be 25.

Course Objectives

To introduce students to the central themes of philosophy

To introduce students to important classical and contemporary philosophers

To introduce students to the methods for doing philosophy

To help students appreciate our own ignorance of even our most fundamental beliefs

Prerequisites

According to the interest of students, topics should be distributed to every student by their class teachers.

A format of project-work should be introduced to students by the HOD.

Project should be submitted one month before examination and pattern should be specified to students.

Textbooks

To be specified by the class teacher

Recommended books:

This is a matter of library consultation.

GENERIC ELECTIVE COURSE (GEC)**Semester I**

Course Code: PHI 311
Course Title: Epistemology and Metaphysics

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

1. Meaning of Philosophy, nature and scope, branches of Philosophy
2. Relationship of Philosophy to science and religion

Unit II:

Sources of knowledge: Rationalism, Empiricism

Unit III:

Theories of Perception:

- A. Realism
 - i. Naive Realism
 - ii. Critical Realism
- B. Idealism
 - i. Subjective Idealism
 - ii. Objective Idealism

Unit IV:

Theories of Truth (Correspondence, Coherence, Pragmatic and Self-Evidence)

Unit V:

Categories of knowledge:

- A. Substance,
- B. Causality (Aristotle and Hume) and
- C. Space-time

Suggested Readings:

1. Hospers, J *An Introduction to Philosophical analysis*, Allied Publishers, Delhi
2. Hamlyn, D.W *Metaphysics*, Cambridge University Press
3. Feibleman, J.K *Understanding Philosophy*, Jaico Publishing House, Mumbai
4. Russell, B *Problems of Philosophy*, Oxford University press
5. Bhattacharjee, H.M *Principles of Philosophy*
6. J.Sinha, *Introduction to Philosophy*
7. J.Sanyal, *Guide to philosophy*

Semester II

Course Code: PHI 321

Course Title: Philosophical concepts: Indian and Western

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

Nature, characteristics and schools of Indian Philosophy

Unit II:

Prama:

A. Svataha-pramanya-vada

i. Vedanta

ii. Mimamsa

iii. Sankhya

B. Paraatha-pramanya-vada

i. Nyaya

Unit III:

Indian theory of Causation: Satkaryavada and Asatkaryavada

Unit IV:

1. Theory of evolution: Darwin and Lamarck

2. Sāṃkhya: *Prakṛti* and *Puruṣa*, Theory of Evolution

Unit V:

God and the world: Deism, Pantheism, Panentheism / Theism

Suggested readings:

1. Ewing, A.C *Fundamental Questions of Philosophy*
2. Chatterjee, S & Datta, D *An Introduction to Indian Philosophy*
3. Titus, H.H *Living issues in Philosophy*, Eurasia Publishing House, New Delhi
4. Hiriyanna, M *Outlines of Indian Philosophy*
5. Sinha, J.N *Introduction to Philosophy*, Central Book Agencies, Calcutta

Semester III

Course Code: PHI 331

Course Title: Ethics

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

Ethics: Nature, scope and relation to religion and politics.
Nature of Morality and Moral Philosophy.

Unit II:

Nature of Moral Judgment

Unit III:

1. Freedom and social responsibility
2. Concept of Good, right and Virtue

Unit IV:

Hedonism: J.S. Mill and Bentham

Unit V:

Regorism: Immanuel Kant

Suggested readings:

1. Lillie, W *Introduction to Ethics*, Allied Publishers, Delhi
2. Frankena, W *Ethics*, Prentice Hall of India, New Delhi
3. Mobbot *Introduction to Ethics*, Hutchington, London
4. Warnock, M *Ethics since 1900*, Oxford University Press
5. Velasquez, M(ed) & Arras, J(ed) *Ethics*, Prentice Hall
6. Padbi, N.C & Panigrabi, S.C *Basic Principles of Ethics*, Santosh Publications
7. Mackenzie *A manual of Ethics*
8. Dr.R.K.Bebera, *Moral Philosophy (A book with a difference)*

Semester IV

Course Code: PHI 341
Course Title: Social and Political Philosophy

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I:

Nature and scope of social and political philosophy and its relation to sociology and social psychology.

Unit II :

Individual, state and Nation

Unit III:

Social ideals: Liberty, equality and social justice

Unit IV:

The concept of social contract

Unit V:

Method of political action: Revolution, terrorism and Satyagraha

Suggested readings:

1. Raphael, D.D *Problems of Political philosophy*, Macmillan, London
2. QUITON, A(ed) *Political philosophy*, Oxford University Press, London.
3. Russell, B *Authority & Individual*, George Allen & Unwin, London
4. Chattopadhyaya, D.P *Societies and culture*, Bharatia Vindhya Bhavan, Mumbai
5. Mabboff *The state and the citizen*
6. Joshi, N.V *Social and Political philosophy*
7. Gandhi, M.K *Hind Swaraj*, Navajivan Publishing House
8. Mashurwalla *Gandhi and Marx*

SKILL ENHANCEMENT COURSE (SEC)**Semester III****Course Code: PHI 531****Course Title: Logic**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Unit I:1. Meaning of Logic, difference between Deductive and Inductive Logic. 2. Truth and validity.

Unit II: 1. Sentence and Proposition. 2. Aristotelian classification of propositions,

Unit III:1. Immediate Inference&Aristotle's Square of Opposition..2. Syllogism: rules and figures

Recommended books:

1. Patrick Suppes: Introduction to Logic, Affiliated East-West press private Ltd., New Delhi
2. A.H.Basson, D.J.O'Connor: Introduction to Symbolic Logic, OxfordUniversity Press,
3. A.Ambrose, M.Lazerowiz: Fundamentals of Symbolic Logic, new York
4. H.Reichenbach: Elements of symbolic logic, new York
5. P.F.Strawson: Introduction to Logical theory, London
6. B.A.W.Russell: Introduction to Mathematical Philosophy. London
7. A.C.Stebbing: Introduction to Modern Logic, S.A.Publishing house, Calcutta
8. F.B.Fitch: Symbolic Logic, New York
9. Irving Copi: Introduction to Logic and symbolic Logic, Macmillan company.
10. Roy,BN. :Text Book of Deductive Logic.
11. Roy, BN : Text Book of Inductive Logic.
12. Cohen & Nagel: Introduction to Logic and Scientific Method.
13. Dr.N.C.Padhi, Deductive logic, Granthamandir, Cuttack-753001

SEMESTER IV**Course Code: PHI 541****Course Title: Environmental Philosophy**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Unit I:

1. Defining environment and nature
2. Social issues,human duties and responsibilities

Unit II:

Man and nature relationship:
 Indian philosophical perspective,
 Religious perspective, (Christianity)

Unit III:

Some Challenges for Environmental Philosophy:Overcoming Anthropocentrism

Recommended books:

1. DR.Hrishikesh Baruah, Dr.Tulika Dey , Environmental studies, Divyaprakahan, Guwahti, 2005
2. Ecology and spirituality, Indian Peace centre, Nagpur
3. Environment and Environmental Philosophy in India *George Alfred James*

4. Gandhi's Contributions to Environmental Thought and Action *Bart Gruzalski*
5. Acting with Compassion: Buddhism, Feminism, and the Environmental Crisis *Stephanie Kazan*
6. *Against Holism: Rethinking Buddhist Environmental Ethics* *Simon P. James*
7. *Belshaw, Christopher (2001). Environmental Philosophy. Chesham: Acumen. ISBN 1-902683-21-8.*
8. *"International Association of Environmental Philosophy". Retrieved 2008-07-30.*
9. Sarkar, 2012. "Environmental philosophy: from theory to practice," Wiley-Blackwell, Chichester, West Sussex.
10. Weston, 1999. "An Invitation to Environmental Philosophy," Oxford University Press, New York, New York.
11. Drengson, Inoue, 1995. "The Deep Ecology Movement," North Atlantic Books, Berkeley, California.
12. Armstrong, Susan, Richard Botzler. *Environmental Ethics: Divergence and Convergence*, McGraw-Hill, Inc., New York, New York.
13. Benson, John, 2000. *Environmental Ethics: An Introduction with Readings*, Psychology Press.
14. Callicott, J. Baird, and Michael Nelson, 1998. *The Great New Wilderness Debate*, University of Georgia Press.
15. Derr, Patrick, G, Edward McNamara, 2003. *Case Studies in Environmental Ethics*, Bowman & Littlefield Publishers, Inc, Lanham, Maryland 20706 [ISBN 0-7425-3136-8](#)
16. Devall, W. and G. Sessions. 1985. *Deep Ecology: Living As if Nature Mattered*, Salt Lake City: Gibbs M. Smith, Inc.
17. Drengson, Inoue, 1995. "The Deep Ecology Movement," North Atlantic Books, Berkeley, California.
18. Foltz, Bruce V., Robert Frodeman. 2004. *Rethinking Nature*, Indiana University Press, 601 North Morton Street, Bloomington, IN 47404-3797 [ISBN 0-253-21702-4](#)
19. Keulartz, Jozef, 1999. *The Struggle for Nature: A Critique of Environmental Philosophy*, Routledge.
20. LaFreniere, Gilbert F, 2007. *The Decline of Nature: Environmental History and the Western World-view*,Academica Press, Bethesda, MD [ISBN 978-1933146409](#)
21. Light, Andrew, and Eric Katz,1996. *Environmental Pragmatism*, Psychology Press.
22. Mannison, D., M. McRobbie, and R. Routley (ed), 1980. *Environmental Philosophy*, Australian National University
23. Matthews, Steve, 2002. *A Hybrid Theory of Environmentalism*, Essays in Philosophy, 3. Online <http://commons.pacificu.edu/cgi/viewcontent.cgi?article=1038&context=eip>
24. Næss, A. 1989. *Ecology, Community and Lifestyle: Outline of an Ecosophy*, Translated by D. Rothenberg. Cambridge: Cambridge University Press.
25. Oelschlaeger, Max, 1993. *The Idea of Wilderness: From Prehistory to the Age of Ecology*, New Haven: Yale University Press, [ISBN 978-0300053708](#)
26. Pojman, Louis P., Paul Pojman. *Environmental Ethics*, Thomson-Wadsworth, United States
27. Sherer, D., ed, Thomas Attig. 1983. *Ethics and the Environment*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey 07632. [ISBN 0-13-290163-3](#)
28. [Vasconcelos, Vitor Vieira "The Environment Professional and the Touch with Nature." *Qualit@s*, v 1, n 1, 2010.](#)
29. VanDeVeer, Donald, Christine Pierce. *The Environmental Ethics and Policy Book*, Wadsworth Publishing Company. An International Thomson Publishing Company
30. Vogel, Steven, 1999. "Environmental Philosophy After the End of Nature," *Environmental Ethics* 24 (1):23-39
31. Weston, 1999. "An Invitation to Environmental Philosophy," Oxford University Press, New York, New York.
32. Zimmerman, Michael E., J. Baird Callicott, George Sessions, Karen J. Warren, John Clark. 1993. *Environmental Philosophy: From Animal Rights to Radical Ecology*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey 07632 [ISBN 0-13-666959-X](#)

POLITICAL SCIENCE HONOURS

| Semester | Core Course | Ability Enhancement Courses | Skill Enhancement Courses | Discipline Specific Elective Courses | Generic Elective Courses |
|---------------------------------|---|-----------------------------|-----------------------------------|--|--|
| First | Understanding Political Theory (6) | Environmental Studies (2) | | | Constitutional Government and Democracy in India (6) |
| | Constitutional Government and Democracy in India (6) | | | | |
| Second | Political Theory: Concepts and Debates (6) | English (2) | | | Political Process in India (6) |
| | Political Process in India (6) | | | | |
| Third | Introduction of Comparative Government and Politics (6) | | Your Laws, Your Rights (2) | | Perspectives of Public Administration (6) |
| | Perspectives of Public Administration (6) | | | | |
| | Perspectives of International Relations and World History (6) | | | | |
| Fourth | Political Process and Institutions in Comparative Perspective (6) | | Peace and Conflict Resolution (2) | | Global Politics (6) |
| | Public Policy & Administration in India (6) | | | | |
| | Global Politics (6) | | | | |
| Fifth | Classical Political Philosophy (6) | | | Human Rights in Comparative Perspectives (6) | |
| | Indian Political Thought-I (6) | | | Indian Foreign Policy in a Globalising World (6) | |
| Sixth | Modern Political Philosophy (6) | | | Women, Power and Politics (6) | |
| | Indian Political Thought-II (6) | | | Society and Politics in Nagaland (6) | |
| No. of Courses (Credits) | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |

Semester I

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: PSC 111

Course Title: UNDERSTANDING POLITICAL THEORY

Course Objective:

This course is divided into two sections. Section A introduces the students to the idea of political theory, its history and approaches, and an assessment of its critical and contemporary trends. Section B is designed to reconcile political theory and practice through reflections on the ideas and practices related to democracy.

Unit I: Political Theory: (12 Lectures)

(a) Meaning, Nature and Scope

(b) Approaches to Political Theory: Normative, Historical and Empirical

Unit II: State and its Origin: (12 Lectures)

Diving Origin Theory

Social Contract Theory

Evolution Theory

Unit III: Notions of State: (12 Lectures)

Liberal

Marxist

Anarchist

Conservative

Unit IV: Government: (12 Lectures)

Separation of Powers: Legislative, Executive and Judiciary

Classification of Government: Parliamentary versus Presidential, Unitary versus Federal

Unit V: Democracy: (12 Lectures)

Liberal

Marxist

Elitist

Pluralist

Essential Readings

I: Introducing Political Theory

1. Bhargava, R. (2008) 'What is Political Theory', in Bhargava, R and Acharya, A. (eds.) *Political Theory: An Introduction*.

New Delhi: Pearson Longman, pp. 2-16.

2. Bellamy, R. (1993) 'Introduction: The Demise and Rise of Political Theory', in Bellamy, R. (ed.) *Theories and Concepts of Politics*. New York: Manchester University Press, pp. 1-14.

3. Glaser, D. (1995) 'Normative Theory', in Marsh, D. and Stoker, G. (eds.) *Theory and Methods in Political Science*.

London: Macmillan, pp. 21-40.

4. Sanders, D. (1995) 'Behavioral Analysis', in Marsh, D. and Stoker, G. (eds.) *Theory and Methods in Political Science*.

London: Macmillan, pp. 58-75.

5. Chapman, J. (1995) 'The Feminist Perspective', in Marsh, D. and Stoker, G. (eds.) *Theory and Methods in Political Science*. London: Macmillan, pp. 94-114.
6. Bhargava, R., 'Why Do We Need Political Theory', in Bhargava, R. and Acharya, A. (eds.) *Political Theory: An Introduction*. New Delhi: Pearson Longman, pp. 17-36.
7. Bannett, J. (2004) 'Postmodern Approach to Political Theory', in Kukathas, Ch. and Gaus, G. F. (eds.) *Handbook of Political Theory*. New Delhi: Sage, pp. 46-54.
8. Vincent, A. (2004) *The Nature of Political Theory*. New York: Oxford University Press, 2004, pp. 19-80.

II: The Grammar of Democracy

1. Srinivasan, J. (2008) 'Democracy', in Bhargava, R. and Acharya, A. (eds.) *Political Theory: An Introduction*. New Delhi: Pearson Longman, pp. 106-128.
2. Owen, D. (2003) 'Democracy', in Bellamy, R. and Mason, A. (eds.) *Political Concepts*. Manchester and New York: Manchester University Press, pp. 105-117.
3. Christiano, Th. (2008) 'Democracy', in Mckinnon, C. (ed.) *Issues in Political Theory*, New York: Oxford University Press, pp. 80-96.
4. Arblaster, A. (1994) *Democracy*. (2nd Edition). Buckingham: Open University Press.
5. Roy, A. 'Citizenship', in Bhargava, R. and Acharya, A. (eds.) *Political Theory: An Introduction*. New Delhi: Pearson Longman, pp. 130-146.
6. Brighouse, H. (2008) 'Citizenship', in Mckinnon, C. (ed.) *Issues in Political Theory*, New York: Oxford University Press, pp. 241-258.

POL. SCIENCE: CORE / GENERIC ELECTIVE COURSE

Semester I

Course Code: a) Core - PSC 112

b) Generic - PSC 311

Course Title: CONSTITUTIONAL GOVERNMENT AND DEMOCRACY IN INDIA

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objective:

This course acquaints students with the constitutional design of state structures and institutions, and their actual working over time. The Indian Constitution accommodates conflicting impulses (of liberty and justice, territorial decentralization and a strong union, for instance) within itself. The course traces the embodiment of some of these conflicts in constitutional provisions, and shows how these have played out in political practice. It further encourages a study of state institutions in their mutual interaction, and in interaction with the larger extra-constitutional environment.

Unit I: The Constituent Assembly and the Constitution (10 lectures)

- (a) Philosophy of the Constitution, the Preamble, and Features of the Constitution

Unit II: Major Features of the Constitution (8 lectures)

Unit III: Notions of State: (12 Lectures)

Liberal
Marxist
Anarchist
Conservative

Unit IV: Government: (12 Lectures)

Separation of Powers: Legislative, Executive and Judiciary
Classification of Government: Parliamentary versus Presidential, Unitary versus Federal

Unit V: Democracy: (12 Lectures)

Liberal
Marxist
Elitist
Pluralist

Essential Readings**I: Introducing Political Theory**

1. Bhargava, R. (2008) 'What is Political Theory', in Bhargava, R and Acharya, A. (eds.) *Political Theory: An Introduction*. New Delhi: Pearson Longman, pp. 2-16.
2. Bellamy, R. (1993) 'Introduction: The Demise and Rise of Political Theory', in Bellamy, R. (ed.) *Theories and Concepts of Politics*. New York: Manchester University Press, pp. 1-14.
3. Glaser, D. (1995) 'Normative Theory', in Marsh, D. and Stoker, G. (eds.) *Theory and Methods in Political Science*. London: Macmillan, pp. 21-40.
4. Sanders, D. (1995) 'Behavioral Analysis', in Marsh, D. and Stoker, G. (eds.) *Theory and Methods in Political Science*. London: Macmillan, pp. 58-75.
5. Chapman, J. (1995) 'The Feminist Perspective', in Marsh, D. and Stoker, G. (eds.) *Theory and Methods in Political Science*. London: Macmillan, pp. 94-114.
6. Bhargava, R., 'Why Do We Need Political Theory', in Bhargava, R. and Acharya, A. (eds.) *Political Theory: An Introduction*. New Delhi: Pearson Longman, pp. 17-36.
7. Bannett, J. (2004) 'Postmodern Approach to Political Theory', in Kukathas, Ch. and Gaus, G. F. (eds.) *Handbook of Political Theory*. New Delhi: Sage, pp. 46-54.
8. Vincent, A. (2004) *The Nature of Political Theory*. New York: Oxford University Press, 2004, pp. 19-80.

II: The Grammar of Democracy

1. Srinivasan, J. (2008) 'Democracy', in Bhargava, R. and Acharya, A. (eds.) *Political Theory: An Introduction*. New Delhi: Pearson Longman, pp. 106-128.
2. Owen, D. (2003) 'Democracy', in Bellamy, R. and Mason, A. (eds.) *Political Concepts*. Manchester and New York: Manchester University Press, pp. 105-117.

Semester II

Course Code: PSC 121

Course Title: POLITICAL THEORY: CONCEPTS AND DEBATES

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Objective:

This course is designed to help the students familiarize with the basic normative concepts of political theory. Each concept is related to a crucial political issue that requires analysis with the aid of our conceptual understanding so as to encourage critical and reflective analysis and interpretation of social practices through the relevant conceptual toolkit. The course design is also intended to introduce the students to the important debates in the subject. These debates prompt us to consider that there is no settled way of understanding concepts and that in the light of new insights and challenges, besides newer ways of perceiving and interpreting the world around us, we inaugurate new modes of political debates.

Unit I: Importance of Freedom (12 Lectures)

Negative Freedom: Liberty

Positive Freedom: Freedom as Emancipation and Development

Unit II: Significance of Equality (12 lectures)

Formal Equality and Equality of Opportunity

Political Equality

Egalitarianism: Background Inequality and Differential Treatment

Unit III: Indispensability of Justice (12 Lectures)

Dimensions of Justice

Procedural and Distributive Justice

Global Justice

Unit IV: The Universality of Rights (12 Lectures)

Kinds of Rights

Liberal-Individualist Theory: Natural Rights

Three Generations of Rights

Rights and Obligations

Unit V: Sovereignty (12 Lectures)

Monistic Theory

Pluralistic Theory

Sovereignty and Territoriality: Current Debates

Essential Readings**Section A: Core Concepts****I. Importance of Freedom**

- Riley, Jonathan. (2008) 'Liberty' in Mckinnon, Catriona (ed.) *Issues in Political Theory*, New York: Oxford University Press, pp. 103-119.
- Knowles, Dudley. (2001) *Political Philosophy*. London: Routledge, pp. 69- 132.
- Swift, Adam. (2001) *Political Philosophy: A Beginners Guide for 4. or Student's and Politicians*. Cambridge: Polity Press, pp. 51-88.
- Carter, Ian. (2003) 'Liberty', in Bellamy, Richard and Mason, Andrew (eds.). *Political Concepts*. Manchester: Manchester University Press, pp. 4-15.

7. Sethi, Aarti. (2008) 'Freedom of Speech and the Question of Censorship', in Bhargava, Rajeev and Acharya, Ashok. (eds.) *Political Theory: An Introduction*. New Delhi: Pearson Longman, pp. 308-319.

II. Significance of Equality

12.. Swift, Adam. (2001) *Political Philosophy: A Beginners Guide for Student's and Politicians*.

3. Cambridge: Polity Press, pp. 91-132.

4. Casal, Paula & William, Andrew. (2008) 'Equality', in McKinnon, Catriona. (ed.) *Issues in Political Theory*. New York:

Oxford University Press, pp. 149- 165.

5. Acharya, Ashok. (2008) 'Affirmative Action', in Bhargava, Rajeev and Acharya, Ashok. (eds.) *Political Theory: An Introduction*. New Delhi: Pearson Longman, pp. 298-30

Introduction. New Delhi: Pearson Longman, pp. 298-30

III. Indispensability of Justice

1. Menon, Krishna. (2008) 'Justice', in Bhargava, Rajeev and Acharya, Ashok. (eds.) *Political Theory: An Introduction*.

New Delhi: Pearson Longman, pp. 74-86.

2. Wolf, Jonathan. (2008) 'Social Justice', in McKinnon, Catriona. (ed.) *Issues in Political Theory*. New York: Oxford

University Press, pp. 172-187.

34.. Swift, Adam. (2001) *Political Philosophy: A Beginners Guide for Student's and Politicians*.

5. Cambridge: Polity Press, pp. 9-48.

6. Knowles, Dudley. (2001) *Political Philosophy*. London: Routledge, pp. 177-238.

7. McKinnon, Catriona. (ed.) (2008) *Issues in Political Theory*. New York: Oxford University Press, pp. 289-305.

8. Bedau, Hugo Adam. (2003) 'Capital Punishment', in LaFollette, Hugh (ed.). *The Oxford Handbook of Practical Ethics*.

New York: Oxford University Press, pp. 705-733.

IV. The Universality of Rights

1. Seglow, Jonathan. (2003) 'Multiculturalism' in Bellamy, Richard and Mason, Andrew (eds.). *Political Concepts*.

Manchester: Manchester University Press, pp. 156-168.

2. Tulkdar, P.S. (2008) 'Rights' in Bhargava, Rajeev and Acharya, Ashok. (eds.) *Political Theory: An Introduction*. New

Delhi: Pearson Longman, pp. 88-104.

3. McKinnon, Catriona. (2003) 'Rights', in Bellamy, Richard and Mason, Andrew. (eds.) *Political Concepts*. Manchester:

Manchester University Press, pp. 16-27.

4. Menlowe, M.A. (1993) 'Political Obligations', in Bellamy Richard. (ed.) *Theories and Concepts of Politics*. New York:

Manchester University Press, pp. 174-194.

5. Amoah, Jewel. (2007) 'The World on Her Shoulders: The Rights of the Girl-Child in the Context of Culture &

Identity', in *Essex Human Rights Review*, 4(2), pp. 1-23.

6. Working Group on the Girl Child (2007), *A Girl's Right to Live: Female Foeticide and Girl Infanticide*, available on

[http://www.crin.org/docs/Girl's infanticide CSW 2007](http://www.crin.org/docs/Girl's%20infanticide%20CSW%202007).

Section B: Major Debates

1. Hyums, Keith. (2008) 'Political Authority and Obligation', in McKinnon, Catriona. (ed.) *Issues in Political Theory*, New

York: Oxford University Press, pp. 9-26

2. Martin, Rex. (2003) 'Political Obligation', in Bellamy, Richard and Mason, Andrew. (eds.) *Political Concepts*, Manchester: Manchester University Press, pp. 41-51.
3. Campbell, Tom. (2008) 'Human Rights' in Mckinnon, Catriona. (ed.) *Issues in Political Theory*. New York: Oxford University Press, pp. 194-210.
4. Mookherjee, Monica, 'Multiculturalism', in Mckinnon, Catriona. (ed.) *Issues in Political Theory*. New York: Oxford University Press, pp. 218- 234.
5. Seglow, Jonathan, 'Multiculturalism', in Bellamy, Richard and Mason, Andrew. (eds.) *Political Concepts*, Manchester: Manchester University Press, pp. 156-168.

POL. SCIENCE: CORE / GENERIC ELECTIVE COURSE

Semester II

Course Code: a) Core - PSC 122
b) Generic - PSC 321

Course Title: POLITICAL PROCESS IN INDIA: Debates and Issues

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objective:

Actual politics in India diverges quite significantly from constitutional legal rules. An understanding of the political process thus calls for a different mode of analysis - that offered by political sociology. This course maps the working of modern institutions, premised on the existence of an individuated society, in a context marked by communitarian solidarities, and their mutual transformation thereby. It also familiarizes students with the working of the Indian state, paying attention to the contradictory dynamics of modern state power.

Unit I: Party System and Voting Behaviour (12 lectures)

Trends in the Party System; From the Congress System to Multi-Party Coalitions
Determinants of Voting Behaviour: Role of Caste, Class, Gender and Religion

Unit II: Political movements in India (12 lectures)

State and Regional Aspirations: Politics of Identity Assertion and Accommodation
Identity Movements: Women, Caste and Class

Unit III: Communalism and Secularism (12 lectures)

Debates on Secularism
Minority and Majority Communalism

Unit IV: Caste and Minority Politics (10 lectures)

Caste in Politics and the Politicization of Caste
Minority Politics: OBC, SC and ST; Affirmative Action Policies

Unit V: The Changing Nature of the Indian State (6 lectures)

Developmental
Welfare
Coercive Dimensions

Essential Readings:

1. R. Kothari, (2002) 'The Congress System', in Z. Hasan (ed.) *Parties and Party Politics in India*, New Delhi: Oxford University Press, pp 39-55.
2. E. Sridharan, (2012) 'Introduction: Theorizing Democratic Consolidation, Parties and Coalitions', in *Coalition Politics and Democratic Consolidation in Asia*, New Delhi: Oxford University Press.

Additional Reading:

- Y. Yadav and S. Palshikar, (2006) 'Party System and Electoral Politics in the Indian States, 1952-2002: From Hegemony to Convergence', in P. deSouza and E. Sridharan (eds.) *India's Political Parties*, New Delhi: Sage Publications, pp. 73-115.

II. Determinants of Voting Behaviour: Caste, Class, Gender and Religion**Essential Readings:**

- Y. Yadav, (2000) 'Understanding the Second Democratic Upsurge', in F. Frankel, Z. Hasan, and R. Bhargava (eds.) *Transforming India: Social and Political Dynamics in Democracy*, New Delhi: Oxford University Press, pp. 120-145.
- C. Jaffrelot, (2008) 'Why Should We Vote? The Indian Middle Class and the Functioning of World's Largest Democracy', in *Religion, Caste and Politics in India*, Delhi: Primus, pp. 604-619.
- Deshpande, (2004) 'How Gendered was Women's Participation in Elections 2004?', *Economic and Political Weekly*, Vol. 39, No. 51, pp. 5431-5436.
- Kumar, (2009) 'Religious Practices Among Indian Hindus', *Japanese Journal of Political Science*, Vol. 10, No. 3, pp. 313-332.

III. Regional Aspirations: The Politics of Secession and Accommodation**Essential Readings:**

- M. Chadda, (2010) 'Integration through Internal Reorganisation', in S. Baruah (ed.) *Ethnonationalism in India: A Reader*, New Delhi: Oxford University Press, pp. 379-402.
- P. Brass, (1999) 'Crisis of National Unity: Punjab, the Northeast and Kashmir', in *The Politics of India Since Independence*, New Delhi: Cambridge University Press and Foundation Books, pp.192-227.

IV. Religion and Politics: Debates on Secularism: Minority and Majority Communalism**Essential Readings:**

- T. Pantham, (2004) 'Understanding Indian Secularism: Learning from its Recent Critics', in R. Vora and S. Palshikar (eds.) *Indian Democracy: Meanings and Practices*, New Delhi: Sage, pp. 235-256.
- N. Menon and A. Nigam, (2007) 'Politics of Hindutva and the Minorities', in *Power and Contestation: India since 1989*, London: Fernwood Publishing, Halifax and Zed Books, pp.36-60.

Additional Reading:

- N. Chandhoke, (2010) 'Secularism', in P. Mehta and N. Jayal (eds.) *The Oxford Companion to Politics in India*, New Delhi: Oxford University Press, pp. 333-346.

V. Caste and Politics: Caste in Politics and the Politicization of Caste

Essential Readings:

R. Kothari, (1970) 'Introduction', in *Caste in Indian Politics*, Delhi: Orient Longman, pp.3-25. M. Weiner, (2001)

'The Struggle for Equality: Caste in Indian Politics', in Atul Kohli (ed.) *The Success of India's Democracy*, New Delhi:

Cambridge University Press, pp. 193-225.

G. Omvedt, (2002) 'Ambedkar and After: The Dalit Movement in India', in G. Shah (ed.) *Social Movements and*

the State, New Delhi: Sage Publications, pp. 293-309.

VI. Affirmative Action Policies: Women, Caste and Class**Essential Readings:**

M. Galanter, (2002) 'The Long Half-Life of Reservations', in Z. Hasan, E. Sridharan and R. Sudarshan (eds.) *India's*

Living Constitution: Ideas, Practices, Controversies, New Delhi: Permanent Black, pp. 306-318.

C. Jaffrelot, (2005) 'The Politics of the OBCs', in *Seminar*, Issue 549, pp. 41-45.

M. John, (2011) 'The Politics of Quotas and the Women's Reservation Bill in India', in M. Tsujimura and J. Steele

(eds.) *Gender Equality in Asia*, Japan: Tohoku University Press, pp. 169-195.

VII. Changing Nature of the Indian State: Developmental, Welfare and Coercive Dimensions**Essential Readings:**

S. Palshikar, (2008) 'The Indian State: Constitution and Beyond', in R. Bhargava (ed.) *Politics and Ethics of the Indian*

Constitution, New Delhi: Oxford University Press, pp. 143-163.

R. Deshpande, (2005) 'State and Democracy in India: Strategies of Accommodation and Manipulation', Occasional

Paper, Series III, No. 4, Special Assistance Programme, Department of Politics and Public Administration, University

of Pune.

M. Mohanty, (1989) 'Duality of the State Process in India: A Hypothesis', *BhartiyaSamajikChintan*, Vol. XII (1-2)

Additional Readings:

T. Byres, (1994) 'Introduction: Development Planning and the Interventionist State Versus Liberalization and the

Neo-Liberal State: India, 1989-1996', in T. Byres (ed.) *The State, Development Planning and Liberalization in India*,

New Delhi: Oxford University Press, 1994, pp.1-35.

A. Verma, (2007) 'Police Agencies and Coercive Power', in S. Ganguly, L. Diamond and M. Plattner (eds.) *The State of*

India's Democracy, Baltimore: John Hopkins University Press, pp. 130-139.

Semester III

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|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: PSC 131

Course Title: INTRODUCTION TO COMPARATIVE GOVERNMENT AND POLITICS

Course objective:

This is a foundational course in comparative politics. The purpose is to familiarize students with the basic concepts and approaches to the study of comparative politics. More specifically the course will focus on examining politics in a historical framework while engaging with various themes of comparative analysis in developed and developing countries.

Unit I: Understanding Comparative Politics (8 Lectures)

Nature and scope

Going beyond Euro-centrism

Unit II: Capitalism (10 Lectures)

Meaning and Development;

Globalization

Unit III: Socialism (10 Lectures)

Meaning and Development

Kinds of socialism

Unit IV: Colonialism and Decolonization (10 Lectures)

Meaning, context, forms of colonialism

Anti-colonialism struggles and process of decolonisation

Unit V: Themes for comparative analysis (22 Lectures)

A comparative study of constitutional development in the following countries:

Britain, United States and China.

I. Understanding Comparative Politics

Essential Readings:

Kopstein, and M. Lichbach, (eds), (2005) *Comparative Politics: Interests, Identities, and Institutions in a Changing Global*

Order. Cambridge: Cambridge University Press, pp.1-5; 16-36; 253-290.

Mohanty, (1975) 'Comparative Political Theory and Third World Sensitivity', in *Teaching Politics*, Nos. 1 and 2, pp.

22-38

Additional Readings:

Roy, (2001) 'Comparative Method and Strategies of Comparison', in *Punjab Journal of Politics*. Vol. xxv (2), pp. 1-15.

Blondel, (1996) 'Then and Now: Comparative Politics', in *Political Studies*. Vol. 47 (1), pp. 152-160.

Chandhoke, (1996) 'Limits of Comparative Political Analysis', in *Economic and Political Weekly*, Vol. 31 (4), January

27, pp. PE 2-PE2-PE8

II Historical context of modern Government

a. Capitalism

Essential Readings:

R. Suresh, (2010) *Economy & Society -Evolution of Capitalism*, New Delhi, Sage Publications, pp. 151-188; 235-268.

G. Ritzer, (2002) *Globalization and Related Process I: Imperialism, Colonialism, Development, Westernization, Easternization*, in *Globalization: A Basic Text*. London: Wiley-Blackwell, pp. 63-84.

Additional Readings:

M. Dobb, (1950) *Capitalism*, in *Studies in the Development of Capitalism*. London: Routledge and Kegan Paul Ltd, pp. 1-32.

E. Wood, (2002) *The Agrarian origin of Capitalism*, in *Origin of Capitalism: A Long View*. London: Verso, pp. 91-95; 166-181.

A. Hoogvelt, (2002) *History of Capitalism Expansion*, in *Globalization and Third World Politics*. London: Palgrave, pp. 14-28.

b. Socialism**Essential Readings:**

A. Brown, (2009) *The Idea of Communism*, in *Rise and Fall of Communism*, Harpercollins (e-book), pp. 1-25; 587-601.

J. McCormick, (2007) *Communist and Post-Communist States*, in *Comparative Politics in Transition*, United Kingdom: Wadsworth, pp. 195-209

Additional Readings:

R. Meek, (1957) *The Definition of Socialism: A Comment*, *The Economic Journal*. 67 (265), pp. 135-139.

c. Colonialism, decolonization& postcolonial society**Essential Readings:**

P. Duara, (2004) *Introduction: The Decolonization of Asia and Africa in the Twentieth Century*, in P. Duara, (ed), *Decolonization: Perspective From Now and Then*. London: Routledge, pp. 1-18.

J. Chiryankandath, (2008) *Colonialism and Post-Colonial Development*, in P. Burnell, et. al, *Politics in the Developing World*. New Delhi: Oxford University Press, pp. 31-52.

Additional Reading:

M. Mohanty, (1999) *Colonialism and Discourse in India and China*, Available at http://www.ignca.nic.in/ks_40033.html http, Accessed: 24.03.2011.

III. Themes for Comparative Analysis**Essential Reading:**

Barrington et. al (2010) *Comparative Politics - Structures & Choices*, Boston, Wadsworth, pp. 212-13; 71-76; 84-89.

Grant, (2009) *United Kingdom Parliamentary System* in *The UK Parliament*. Edinburgh: Edinburgh University Press, pp. 24-43

McCormick, (2007) *Comparative Politics in Transition*, UK: Wadsworth, pp. 260-270 (China)

Kesselman, J. Krieger and William (2010), *Introduction to Comparative Politics: Political Challenges and Changing Agendas*,

UK: Wadsworth. pp. 47-70 (Britain); 364- 388 (Nigeria); 625-648 (China); 415-440 (Brazil).

Additional Reading:

P. Rutland, (2007) *Britain*, in J. Kopstein and M. Lichbach. (eds.) *Comparative Politics: Interest, Identities*

Semester III

Course Code: a) Core - PSC 132
b) Generic - PSC 331

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Title: PERSPECTIVES ON PUBLIC ADMINISTRATION

Objective:

The course provides an introduction to the discipline of public administration. This paper encompasses public administration in its historical context with an emphasis on the various classical and contemporary administrative theories. The course also explores some of the recent trends, including feminism and ecological conservation and how the call for greater democratization is restructuring public administration. The course will also attempt to provide the students a comprehensive understanding on contemporary administrative developments.

Unit I: Public Administration as a Discipline (15 Lectures)

Meaning, Dimensions and Significance of the Discipline
Public and Private Administration
Evolution of Public Administration

Unit II: Classical Theories (7 Lectures)

Scientific Management Theory
Administrative Management (Gullick, Urwick and Fayol)
Ideal-Type Bureaucracy (Max Weber)

Unit III: Neo-Classical Theories (7 Lectures)

Human Relations Theory (Elton Mayo)
Rational Decision-making theory (Herbert Simon)

Unit IV: Contemporary Theories (10 Lectures)

Ecological Approach (Fred Riggs)
Innovation and Entrepreneurship (Peter Drucker)

Unit V: Major Approaches in Public Administration (28 Lectures)

Development Administration
New Public Administration
New Public Management
New Public Service Approach
Good Governance
Feminist Perspectives

READINGS**I. Public Administration as a Discipline****a. Meaning, Dimensions and Significance of the Discipline.**

Nicholas Henry, *Public Administration and Public Affairs*, Prentice Hall, 1999

D. Rosenbloom, R. Kravchuk. and R. Clerkin, (2009) *Public Administration: Understanding Management, Politics and*

Law in Public Sector, 7th edition, New Delhi: McGraw Hill, pp. 1-40

W. Wilson, (2004) 'The Study of Administration', in B. Chakrabarty and M. Bhattacharya (eds), *Administrative*

Change and Innovation: a Reader, New Delhi: Oxford University Press, pp. 85-101

Basu, Rumki, *Public Administration: Concepts and Theories* Sterling Publishers, New Delhi 2014

b. Public and Private Administration.

M. Bhattacharya, (2008) *New Horizons of Public Administration*, 5th Revised Edition. New Delhi: Jawahar Publishers, pp. 37-44.

G. Alhson, (1997) 'Public and Private Management', in Shafritz, J. and Hyde, A. (eds.) *Classics of Public Administration*, 4th Edition. Fort Worth: Hartcourt Brace, TX, pp. 510-529.

Evolution of Public Administration

N. Henry, *Public Administration and Public Affairs*, 12th edition. New Jersey: Pearson, 2013

M. Bhattacharya, *Restructuring Public Administration: A New Look*, New Delhi: Jawahar Publishers, 2012

P. Dunleavy and C. Hood, 'From Old Public Administration to New Public Management', *Public Money and Management*, Vol. XIV No-3, 1994

M. Bhattacharya, *New Horizons of Public Administration*, New Delhi: Jawahar Publishers, 2011

II. Theoretical Perspectives Scientific**Management**

D. Gvishiani, *Organisation and Management*, Moscow: Progress Publishers, 1972

F. Taylor, 'Scientific Management', in J. Shafritz, and A. Hyde, (eds.) *Classics of Public Administration*, 5th

Edition. Belmont: Wadsworth, 2004

P. Mouzelis, 'The Ideal Type of Bureaucracy' in B. Chakrabarty, and M. Bhattacharya, (eds), *Public Administration: A Reader*, New Delhi: Oxford University Press, 2003

A Reader, New Delhi: Oxford University Press, 2003

Administrative Management

Ravindra Prasad, Y. Pardhasaradhi, V. S. Prasad and P. Satyarnarayana, [eds.], *Administrative Thinkers*, Sterling

Publishers, 2010

J. Ferreira, A. W. Erasmus and D. Groenewald, *Administrative Management*, Juta Academics, 2010

Ideal Type-Bureaucracy

Weber, 'Bureaucracy', in C. Mills, and H. Gerth, *From Max Weber: Essays in Sociology*. Oxford: Oxford University

Press, 1946

Warren. G. Bennis, *Beyond Bureaucracy*, McGraw Hill, 1973

Human Relations Theory

D. Gvishiani, *Organisation and Management*, Moscow: Progress Publishers, 1972

B. Miner, 'Elton Mayo and Hawthorne', in *Organisational Behaviour 3: Historical Origins and the Future*. New York:

M.E. Sharpe, 2006

Rational-Decision Making

S. Maheshwari, *Administrative Thinkers*, New Delhi: Macmillan, 2009

Fredrickson and Smith, 'Decision Theory', in *The Public Administration Theory Primer*. Cambridge: West-

view

Press, 2003

Ecological approach

R. Arora, 'Riggs' Administrative Ecology' in B. Chakrabarty and M. Bhattacharya (eds), *Public Administration: A*

reader, New Delhi, Oxford University Press, 2003

A. Singh, *Public Administration: Roots and Wings*. New Delhi: Galgotia Publishing Company, 2002

F. Riggs, *Administration in Developing Countries: The Theory of Prismatic Society*. Boston: Houghton Mifflin, 1964

Innovation and Entrepreneurship

Peter Drucker, *Innovation and Entrepreneurship*, Harper Collins, 1999

Peter F. Drucker, *The Practice of Management*, Harper Collins, 2006

III. Public Policy

Concept, Relevance and Approaches

T. Dye, (1984) *Understanding Public Policy*, 5th Edition. U.S.A: Prentice Hall, pp. 1-44

The Oxford Handbook of Public Policy, OUP, 2006

Xun Wu, M.Ramesh, Michael Howlett and Scott Fritzen, *The Public Policy Primer: Managing The Policy Process*, Rutledge, 2010

Mary Jo Hatch and Ann L. Cunliffe *Organisation Theory :Modern, Symbolic and Postmodern Perspectives*, Oxford

University Press, 2006

Michael Howlett, *Designing Public Policies : Principles And Instruments*, Rutledge, 2011 *The Oxford Handbook Of Public Policy*,

Oxford University Press, 2006

Formulation, implementation and evaluation

Prabir Kumar De, *Public Policy and Systems*, Pearson Education, 2012

R.V. VaidyanathaAyyar, *Public Policy Making In India*, Pearson, 2009

Surendra Munshi and Biju Paul Abraham [Eds.] *Good Governance, Democratic Societies And Globalisation*, Sage Publishers, 2004

2004

IV. Major Approaches in Public Administration

a. Development administration

M. Bhattacharya, _Chapter 2 and 4', in *Social Theory, Development Administration and Development Ethics*, New Delhi: Jawahar

Publishers, 2006

F. Riggs, *The Ecology of Public Administration, Part 3*, New Delhi: Asia Publishing House, 1961

b. New Public Administration

Essential Reading:

M. Bhattacharya, *Public Administration: Issues and Perspectives*, New Delhi: Jawahar Publishers, 2012

H. Frederickson, _Toward a New Public Administration', in J. Shafritz, & A. Hyde, (eds.) *Classics of Public Administration*,

5th Edition, Belmont: Wadsworth, 2004

c. New Public Management

U. Medury, *Public administration in the Globalization Era*, New Delhi: Orient Black Swan, 2010

A. Gray, and B. Jenkins, _From Public Administration to Public Management' in E. Otenyo and N. Lind, (eds.)

Comparative Public Administration: The Essential Readings: Oxford University Press, 1997

C. Hood, _A Public Management for All Seasons', in J. Shafritz, & A. Hyde, (eds.) *Classics of Public Administration*,

5th Edition, Belmont: Wadsworth, 2004

d. New Public Service Approach

R.B.Denhardt&J.V.Denhardt [Arizona State University] — The New Public Service: Serving Rather Than Steering, in *Public Administration Review*, Volume 60, No-6, November-December 2000

e. Good Governance

A. Leftwich, _Governance in the State and the Politics of Development', in *Development and Change*. Vol. 25, 1994

M. Bhattacharya, _Contextualizing Governance and Development' in B. Chakrabarty and

M. Bhattacharya, (eds.) *The Governance Discourse*. New Delhi: Oxford University Press, 1998 B. Chakrabarty, *Reinventing*

Public Administration: The India Experience. New Delhi: Orient Longman, 2007

U. Medury, *Public administration in the Globalisation Era*, New Delhi: Orient Black Swan, 2010

f. Feminist Perspective

Camila Stivers, *Gender Images In Public Administration*, California : Sage Publishers, 2002
 Radha Kumar, *The History of Doing*, New Delhi: Kali For Women, 1998
 Sylvia Walby, *Theorising Patriarchy*, Oxford, Basil Blackwell, 1997
 Amy. S. Wharton, *The Sociology Of Gender*, West Sussex : Blackwell-Wiley Publishers, 2012
 Nivedita Menon [ed.], *Gender and Politics*, Delhi: Oxford University Press, 1999
 Simone De Beauvoir, *The Second Sex*, London: Picador, 1988
 Alison Jaggar, *Feminist Politics And Human Nature*, Brighton: Harvester Press, 1983
 Maxine Molyneux and Shahra Razavi, *Gender, Justice, Development and Rights*, Oxford: Oxford University Press, 2002

Semester III

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: PSC 133**Course Title: PERSPECTIVES ON INTERNATIONAL RELATIONS AND WORLD HISTORY****Course Objective:**

This paper seeks to equip students with the basic intellectual tools for understanding International Relations. It introduces students to some of the most important theoretical approaches for studying international relations. The course begins by historically contextualizing the evolution of the international state system before discussing the agency-structure problem through the levels-of-analysis approach. After having set the parameters of the debate, students are introduced to different theories in International Relations. It provides a fairly comprehensive overview of the major political developments and events starting from the twentieth century. Students are expected to learn about the key milestones in world history and equip them with the tools to understand and analyze the same from different perspectives. A key objective of the course is to make students aware of the implicit Euro-centricism of International Relations by highlighting certain specific perspectives from the Global South.

Unit I: Studying International Relations (10 Lectures)

Understanding International Relations (IR): Levels of Analysis
 History and IR: Emergence of the International State System
 Pre-Westphalia, Westphalia and Post-Westphalia

Unit II: Theoretical Perspectives (25 Lectures)

Classical Realism & Neo-Realism
 Liberalism & Neo-liberalism
 Marxist Approaches
 Feminist Perspectives
 Euro-centrism and Perspectives from the Global South

Unit III: An Overview of Twentieth Century IR History: WWI and WWII (12 lectures)

World War I: Causes and Consequences
 Significance of the Bolshevik Revolution
 Rise of Fascism / Nazism
 World War II: Causes and Consequences

Unit IV: An Overview of Twentieth Century IR History: Cold War Era (8 lectures)

Cold War: Different Phases

Emergence of the Third World

Collapse of the USSR and the End of the Cold War

Unit V: Post-Cold War Developments (5 Lectures)

Post-Cold War Developments

Emergence of Other Power Centres of Power

Essential Readings:

M. Nicholson, (2002) *International Relations: A Concise Introduction*, New York: Palgrave, pp. 1-4.

Jackson and G. Sorensen, (2007) *Introduction to International Relations: Theories and Approches*, 3rd Edition, Oxford: Oxford

University Press, pp. 2-7

Joshua. Goldstein and J. Pevehouse, (2007) *International Relations*, New York: Pearson Longman, 2007, pp. 29-35

C. Brown and K. Ainley, (2009) *Understanding International Relations*, Basingstoke: Palgrave, pp. 1-16.

Additional Readings:

K. Mingst and J. Snyder, (2011) *Essential Readings in International Relations*, New York: W.W. Norton and Company,

pp. 1-15.

M. Smith and R. Little, (eds) (2000) 'Introduction', in *Perspectives on World Politics*, New York: Routledge, 2000, 1991, pp.

1-17.

J. Baylis and S. Smith (eds), (2008) *The Globalization of World Politics: An Introduction to International Relations*, New York:

Oxford University Press, pp. 1-6.

R. Mansbach and K. Taylor, (2008) *Introduction to Global Politics*, New York: Routledge, pp. 2-32.

Rumki Basu, (ed)(2012) *International Politics: Concepts, Theories and Issues* New Delhi, Sage.

History and IR: Emergence of the International State System:**Essential Readings:**

R. Mansbach and K. Taylor, (2012) *Introduction to Global Politics*, New York: Routledge, pp. 33-68.

K. Mingst, (2011) *Essentials of International Relations*, New York: W.W. Norton and Company, pp. 16-63.

P. Viotti and M. Kauppi, (2007) *International Relations and World Politics: Security, Economy, Identity*, Pearson Education, pp.

40-85.

Additional Readings:

J. Baylis, S. Smith and P. Owens, (2008) *The Globalization of World Politics: An Introduction to International Relations*, New

York: Oxford University Press, pp. 36-89.

R. Mansbach and K. Taylor, (2008) *Introduction to Global Politics*, New York: Routledge, pp. 70-135.

J Goldstein and J. Pevehouse, (2007) *International Relations*, New York: Pearson Longman, pp. 50-69.

E. Hobsbawm, (1995) *Age of Extremes: The Short Twentieth Century 1914-1991*, Vikings.

S. Lawson, (2003) *International Relations*, Cambridge: Polity Press, pp. 21-60.

How do you Understand IR (Levels of Analysis):**Essential Readings:**

J. Singer, (1961) 'The International System: Theoretical Essays', *World Politics*, Vol. 14(1), pp. 77-92.

B. Buzan, (1995) 'The Level of Analysis Problem in International Relations Reconsidered', in

K. Booth and S. Smith, (eds), *International Relations Theory Today*, Pennsylvania: The Pennsylvania State University Press,

pp. 198-216.

Additional Readings:

K. Mingst, (2011) *Essentials of International Relations*, New York: W.W. Norton and Company, pp. 93-178.

Goldstein and J. Pevehouse, (2007) *International Relations*, New York: Pearson Longman, pp. 35-49.

Waltz, (1959) *Man, The State and War*, Columbia: Columbia University Press.

Theoretical Perspectives:**Classical Realism and Neorealism****Essential Readings:**

E. Carr, (1981) *The Twenty Years Crisis, 1919-1939: An Introduction to the Study of International Relations*, London: Macmillan,

pp. 63-94.

H. Morgenthau, (2007) 'Six Principles of Political Realism', in R. Art and R. Jervis, *International Politics*, 8th Edition,

New York: Pearson Longman, pp. 7-14.

T. Dunne and B. Schmidt, (2008) 'Realism', in J. Baylis and S. Smith (eds), *The Globalization of World Politics: An Introduction*

to *International Relations*, New York: Oxford University Press, pp. 90-107.

K. Waltz, (2007) 'The Anarchic Structure of World Politics', in R. Art and R. Jervis, *International Politics*, 8th Edition,

New York: Pearson Longman, pp. 29-49.

Additional Readings:

M. Nicholson, (2002) *International Relations: A Concise Introduction*, New York: Palgrave, pp. 6-7.

H. Bull, (2000) 'The Balance of Power and International Order', in M. Smith and R. Little (eds), *Perspectives on World*

Politics, New York: Routledge, pp. 115-124.

Liberalism and Neoliberalism**Essential Readings:**

T. Dunne, (2008) 'Liberalism', in J. Baylis and S. Smith (eds.), *The Globalization of World Politics: An Introduction to*

International Relations, New York: Oxford University Press, pp.108-123.

R. Keohane and J. Nye, (2000) 'Transgovernmental Relations and the International Organization', in M. Smith and R.

Little (eds.), *Perspectives on World Politics*, New York: Routledge, pp. 229-241.

Additional Readings:

J. Goldstein and J. Pevehouse, (2007) *International Relations*, New York: Pearson Longman, pp. 127-137.

R. Jackson and G. Sorensen, (2007) *Introduction to International Relations: Theories and Approaches*, 3rd Edition, Oxford:

Oxford University Press, pp. 97-128.

Marxist Approaches**Essential Readings:**

I. Wallerstein, (2000) 'The Rise and Future Demise of World Capitalist System: Concepts for Comparative Analysis', in

Michael Smith and Richard Little (eds), *Perspectives on World Politics*, New York: Routledge, pp. 305-317.

S. Hobden and R. Jones, (2008) 'Marxist Theories of International Relations' in J. Baylis and S. Smith (eds), *The Globalization of World Politics: An Introduction to International Relations*, New York: Oxford University Press, pp. 142-149; 155-158.

J. Goldstein and J. Pevehouse, (2007) *International Relations*, New York: Pearson Longman, pp. 494-496; 500-503.

Additional Readings:

J. Galtung, (2000) 'A Structural Theory of Imperialism', in M. Smith and R. Little, (eds), *Perspectives on World Politics*,

New York: Routledge, pp. 292-304.

A. Frank, (1966) 'The Development of Underdevelopment' *Monthly Review*, pp. 17-30.

P. Viotti and M. Kauppi (2007), *International Relations and World Politics: Security, Economy, Identity*, Pearson Education, pp. 40-85.

Modern History Sourcebook: Summary of Wallerstein on World System Theory, Available at <http://www.fordham.edu/halsall/mod/Wallerstein.asp>, Accessed: 19.04.2013

Feminist Perspectives

Essential Readings:

J. Tickner, (2007) 'A Critique of Morgenthau's Principles of Political Realism', in R. Art and R. Jervis, *International*

Politics, 8th Edition, New York: Pearson Longman, pp. 15-28.

F. Halliday, (1994) *Rethinking International Relations*, London: Macmillan, pp. 147-166. Additional Readings:

M. Nicholson, *International Relations: A Concise Introduction*, New York: Palgrave, 2002, pp. 120-122.

J. Goldstein and J. Pevehouse, (2007) *International Relations*, New York: Pearson Longman, pp. 138-148.

S. Smith and P. Owens, (2008) 'Alternative Approaches to International Theory' in J. Baylis and S. Smith (eds), *The Globalization of World Politics: An Introduction to International Relations*, New York: Oxford University Press, pp. 181-184.

IR, Eurocentrism and Perspectives from the Global South on Eurocentrism

Essential Readings:

A. Acharya and B. Buzan, (2007) 'Why Is There No Non- Western IR Theory: Reflections on and From Asia',

International Relations Of The Asia- Pacific, Vol 7(3), pp. 285-286.

T. Kayaoglu, (2010) 'WestphalianEurocentrism in I R Theory', in *International Studies Review*, Vol. 12(2), pp. 193-217.

Additional Readings:

O. Weaver and A. Tickner, (2009) 'Introduction: Geocultural Epistemologies', in A. Tickner and O. Waever (eds),

International Relations: Scholarship Around The World, London: Routledge, pp. 1-31.

Kanth (ed), (2009) *The Challenge of Eurocentrism: Global Perspectives, Policy & Prospects*, New York: Palgrave-McMillan.

Amin, (2010) *Eurocentrism: Modernity, Religion & Democracy*, New York: Monthly Review Press.

An Overview of Twentieth Century IR History

(a) World War I: Causes and Consequences

Hobsbawm, E. (1995) *Age of Extreme: The Short Twentieth Century, 1914—1991*. London: Abacus, pp. 22-35.

(b) Significance of the Bolshevik Revolution

(c) Rise of Fascism / Nazism

Hobsbawm, E. (1995) *Age of Extreme: The Short Twentieth Century, 1914—1991*. London: Abacus, pp. 108-141.

Carr, E.H. (2004) *International Relations between the Two World Wars: 1919-1939*. New York: Palgrave, pp. 197-231 and 258-278.

(d) World War II: Causes and Consequences

Taylor, A.J.P. (1961) *The Origins of the Second World War*. Harmondsworth: Penguin, pp.29-65.

Carruthers, S.L. (2005) 'International History, 1900-1945' in Baylis, J. and Smith, S. (eds.) (2008) *The Globalization of World Politics. An Introduction to International Relations*. 4th edn. Oxford: Oxford University Press, pp. 76-84.

(e) Cold War: Different Phases

Calvocoressi, P. (2001) *World Politics: 1945—2000*. Essex: Pearson, pp. 3-91.

Scott, L. (2005) 'International History, 1945-1990' in Baylis, J. and Smith, S. (eds.) (2008) *The Globalization of World*

Politics. An Introduction to International Relations. 4th edn. Oxford: Oxford University Press, pp. 93-101.

Hobsbawm, E. (1995) *Age of Extreme: The Short Twentieth Century, 1914—1991*. London: Abacus, pp. 225-226.

(f) Emergence of the Third World

Hobsbawm, E. (1995) *Age of Extreme: The Short Twentieth Century, 1914—1991*. London: Abacus, pp. 207-222.

(g) Collapse of the USSR and the End of the Cold War

Scott, L. (2005) 'International History, 1945-1990' in Baylis, J. and Smith, S. (eds.) (2008) *The Globalization of World*

Politics. An Introduction to International Relations. 4th edn. Oxford: Oxford University Press, pp. 93-101.

(h) Post Cold War Developments and Emergence of Other Power Centres of Power: Japan, European Union**(EU) and Brazil, Russia, India, China (BRIC)**

Brezeznski, Z. (2005) *Choice: Global Dominance or Global Leadership*. New York: Basic Books, pp. 85-127.34

Gill, S. (2005) 'Contradictions of US Supremacy' in Panitch, L. and Leys, C. (eds.) *Socialist Register: The Empire Reloaded*.

London: Merlin Press. 2004, London, Merlin Press and New York, Monthly Review Press. *Socialist Register*, pp.24-47.

Therborn, G. (2006) 'Poles and Triangles: US Power and Triangles of Americas, Asia and Europe' in Hadiz, V.R. (ed.)

Empire and Neo Liberalism in Asia. London: Routledge, pp.23-37.

Semester IV

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: PSC 141

Course Title: POLITICAL PROCESSES AND INSTITUTIONS IN COMPARATIVE PERSPECTIVE

Course objective:

In this course students will be trained in the application of comparative methods to the study of politics. The course is comparative in both what we study and how we study. In the process the course aims to introduce undergraduate students to some of the range of issues, literature, and methods that cover comparative political.

Unit I: Approaches to Comparative Politics: (12 Lectures)

Political Culture
New Institutionalism

Unit II: Electoral Systems (12 Lectures)

First-Past-The-Post System
Proportional Representation System
Mixed Representation System

Unit III: Party System (12 Lectures)

Historical Contexts of the Emergence of the Party System
Types of Parties

Unit IV: Nation-State (12 Lectures)

Historical Evolution in Western Europe
Nation-State in Post-Colonial Context, Nation and State debates

Unit V: Democratization: Process of Democratization (12 Lectures)

Post-Colonial States
Post-Authoritarian States
Post-Communist States

READING LIST**I: Approaches to Studying Comparative Politics****Essential Readings:**

M. Pennington, (2009) 'Theory, Institutional and Comparative Politics', in J. Bara and Pennington. (eds.) *Comparative*

Politics: Explaining Democratic System. Sage Publications, New Delhi, pp. 13-40.

M. Howard, (2009) 'Culture in Comparative Political Analysis', in M. Lichback and A. Zuckerman, pp. 134- S. (eds.)

Comparative Political: Rationality, Culture, and Structure. Cambridge: Cambridge University Press.

B. Rosamond, (2005) 'Political Culture', in B. Axford, et al. *Politics*, London: Routledge, pp. 57-81.

Additional Readings:

P. Hall, Taylor and C. Rosemary, (1996) 'Political Science and the Three New Institutionalism', *Political Studies*. XLIV,

pp. 936-957.

L. Rakner, and R. Vicky, (2011) 'Institutional Perspectives', in P. Burnell, et al. (eds.) *Political in the Developing World*.

Oxford: Oxford University Press, pp. 53-70.

II: Electoral System**Essential Readings:**

Heywood, (2002) 'Representation, Electoral and Voting', in *Politics*. New York: Palgrave, pp. 223-245.

Evans, (2009) 'Elections Systems', in J. Bara and M. Pennington, (eds.) *Comparative politics*. New Delhi: Sage Publications, pp. 93-119.

Additional Reading:

R. Moser, and S. Ethan, (2004) 'Mixed Electoral Systems and Electoral System Effects: Controlled Comparison and

Cross-national Analysis', in *Electoral Studies*. 23, pp. 575-599.

III: Party System**Essential Readings:**

A. Cole, (2011) 'Comparative Political Parties: Systems and Organizations', in J. Ishiyama, and M. Breuning, (eds) *21st*

Century Political Science: A Reference Book. Los Angeles: Sage Publications, pp. 150-158.

A. Heywood, (2002) 'Parties and Party System', in *Politics*. New York : Palgrave, pp. 247-268.

Additional Readings:

B. Criddle, (2003) 'Parties and Party System', in R. Axtmann, (ed.) *Understanding Democratic Politics: An Introduction*.

London: Sage Publications, pp. 134-142.

IV: Nation-state**Essential Readings:**

W. O'Conner, (1994) 'A Nation is a Nation, is a State, is a Ethnic Group, is a ...', in J. Hutchinson and A. Smith,

(eds.) *Nationalism*. Oxford: Oxford University Press, pp. 36-46.

K. Newton, and J. Deth, (2010) 'The Development of the Modern State', in *Foundations of Comparative Politics: Democracies of the Modern World*. Cambridge: Cambridge University Press, pp. 13-33.

Additional Reading:

A. Heywood, (2002), 'The State', in *Politics*. New York: Palgrave, pp. 85-102

V. Democratization**Essential Readings:**

T. Landman, (2003) 'Transition to Democracy', in *Issues and Methods of Comparative Methods: An Introduction*. London:

Routledge, pp. 185-215.

K. Newton, and J. Deth, (2010) 'Democratic Change and Persistence', in *Foundations of Comparative Politics: Democracies*

of the Modern World. Cambridge: Cambridge University Press, pp. 53-67.

J. Haynes, (1999) 'State and Society', in *The Democratization*. Oxford: Blackwell, pp. 20-38; 39-63.

Additional Reading:

B. Smith, (2003) 'Democratization in the Third World', in *Understanding Third World Politics: Theories of Political Change*

and Development. London: Palgrave Macmillan, pp.250-274.

VI: Federalism**Essential Readings:**

M. Burgess, (2006) *Comparative Federalism: Theory and Practice*. London: Routledge, pp. 135-161.

R. Watts, (2008) 'Introduction', in *Comparing Federal Systems*. Montreal and Kingston: McGill Queen's University Press,

pp. 1-27

Additional Reading:

R. Saxena, (2011) 'Introduction', in Saxena, R (eds.) *Varieties of Federal Governance: Major Contemporary Models*. New

Delhi: Cambridge University Press, pp. xii-x1.

Semester IV

Course Code: PSC 142
Course Title: PUBLIC POLICY AND ADMINISTRATION IN INDIA

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

The paper seeks to provide an introduction to the interface between public policy and administration in India. The essence of public policy lies in its effectiveness in translating the governing philosophy into programs and policies and making it a part of the community living. It deals with issues of decentralization, financial management, citizens and administration and social welfare from a non-western perspective.

Unit I: Public Policy (10 Lectures)

Definition, Characteristics and Models
Public Policy Process in India: Formulation, Implementation and Evaluation

Unit II: Planning and Administration in India (10 Lectures)

Meaning and Kinds, Planning Commission and NITI Ayog: Composition, Organization, functions and process of planning
National Development Council: Structure and Functions

Unit III: Budget (12 Lectures)

Concept and Significance of Budget
Budget Cycle in India
Types of Budgeting

Unit IV: Citizen and Administrative Interface (15 Lectures)

Public Service Delivery
Redressal of Public Grievances: RTI, Lokpal, Citizen's Charter and E-Governance
Rights of the Consumers

Unit V: Social Welfare Administration (20 Lectures)

Concept and Approaches of Social Welfare
Social Welfare Policies: Right to Education, National Health Mission, Right to Food Security, MNREGA-

READINGS**I. Public Policy**

T. Dye, (1984) *Understanding Public Policy*, 5th Edition. U.S.A: Prentice Hall
R.B. Denhardt and J.V. Denhardt, (2009) *Public Administration*, New Delhi: Brooks/Cole
J. Anderson, (1975) *Public Policy Making*. New York: Thomas Nelson and sons Ltd.
M. Howlett, M. Ramesh, and A. Perl, (2009), *Studying Public Policy: Policy Cycles and Policy subsystems*, 3rd edition, Oxford:
Oxford University Press
T. Dye, (2002) *Understanding Public Policy*, New Delhi: Pearson
Y. Dror, (1989) *Public Policy Making Reexamined*. Oxford: Transaction Publication

II. Decentralization

Satyajit Singh and Pradeep K. Sharma [eds.] *Decentralisation: Institutions And Politics In Rural India*, OUP,2007
D. A. Rondinelli and S.Cheema, *Decentralisation and Development*, Beverly Hills: Sage Publishers, 1983

N.G.Jayal, *Democracy and The State: Welfare, Secular and Development in Contemporary India*, Oxford : Oxford University Press,1999

BidyutChakrabarty, *Reinventing Public Administration: The Indian Experience*, Orient Longman,2007

NoorjahanBava, *Development Policies and Administration in India*, Delhi: Uppal Publishers, 2001

III. Budget

Erik-Lane, J. (2005) *Public Administration and Public Management: The Principal Agent Perspective*. New York: Routledge

Henry, N.(1999) *Public Administration and Public Affairs*. New Jersey:Prentice Hall

Caiden, N.(2004) = Public Budgeting Amidst Uncertainty and Instability', in Shafritz, J.M. & Hyde, A.C. (eds.) *Classics of*

Public Administration. Belmont: Wadsworth

IV. Citizen And Administration Interface

R. Putnam *Making Democracy Work*, Princeton University Press, 1993

Jenkins, R. and Goetz, A.M. (1999) =Accounts and Accountability: Theoretical Implications of the Right to Information

Movement in India', in *Third World Quarterly*.June

Sharma, P.K. &Devasher, M. (2007) =Right to Information in India' in Singh, S. and Sharma, P. (eds.) *Decentralization:*

Institutions and Politics in Rural India. New Delhi: Oxford University Press

Vasu Deva, *E-Governance In India: A Reality*, Commonwealth Publishers, 2005

World Development Report, World Bank, Oxford University Press, 1992.

M.J.Moon, *The Evolution of Electronic Government Among Municipalities: Rhetoric or Reality*, American Society For Public

Administration, *Public Administration Review*, Vol 62, Issue 4, July –August 2002

Pankaj Sharma, *E-Governance: The New Age Governance*, APH Publishers, 2004

Pippa Norris, *Digital Divide: Civic Engagement, Information Poverty and the Internet in Democratic Societies*, Cambridge: Cambridge

University Press, 2001.

Stephan Goldsmith and William D. Eggers, *Governing By Network: The New Shape of the Public Sector*, Brookings Institution

[Washington], 2004

United Nation Development Programme, *Reconceptualising Governance*, New York, 1997 Mukhopadyay, A. (2005)

=Social Audit', in *Seminar*.No.551.

V. Social Welfare Administration

Jean Drèze and Amartya Sen, *India, Economic Development and Social Opportunity*, Oxford: Oxford University Press, 1995

J.Dreze and Amartya Sen, *Indian Development: Selected Regional Perspectives*, Oxford: Clarendon Press, 1997

ReetikaKhera- Rural Poverty And Public Distribution System, EPW, Vol-XLVIII, No.45-46, Nov 2013

PradeepChaturvedi [ed.], *Women And Food Security: Role Of Panchayats*, Concept Publishers, 1997

National Food Security Mission: nfsm.gov.in/Guidelines/XIIPlan/NFSMXII.pdf

Jugal Kishore, *National Health Programs of India: National Policies and Legislations*, Century Publications, 2005

K. Lee and Mills, *The Economic Of Health In Developing Countries*, Oxford: Oxford University Press, 1983

K. Vijaya Kumar, *Right to Education Act 2009: Its Implementation as to Social Development in India*, Delhi: Akansha Publishers,

2012.

Marma Mukhopadhyay and MadhuParhar(ed.) *Education in India: Dynamics of Development*, Delhi: Shipra Publications,

2007

NaliniJuneja, *Primary Education for All in the City of Mumbai: The Challenge Set By Local Actors'*, International Institute For

Educational Planning, UNESCO: Paris, 2001

Surendra Munshi and Biju Paul Abraham [eds.] *Good Governance, Democratic Societies and Globalisation*, Sage Publishers,

2004

Basu Rumki (2015) *Public Administration in India Mandates, Performance and Future Perspectives*, New Delhi, Sterling Publishers

www.un.org/millenniumgoals <http://www.cefsindia.org> www.righttofoodindia.org

Semester IV

Course Code: a) Core - PSC 143
b) Generic - PSC 341
Course Title: GLOBAL POLITICS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objective:

This course introduces students to the key debates on the meaning and nature of globalization by addressing its political, economic, social, cultural and technological dimensions. In keeping with the most important debates within the globalization discourse, it imparts an understanding of the working of the world economy, its anchors and resistances offered by global social movements while analyzing the changing nature of relationship between the state and trans-national actors and networks. The course also offers insights into key contemporary global issues such as the proliferation of nuclear weapons, ecological issues, international terrorism, and human security before concluding with a debate on the phenomenon of global governance.

Unit I: Globalization: Conceptions and Perspectives (6 lectures)

- (a) Understanding Globalization: Meaning and Significance of Globalization
- (b) Theories of Globalization

Unit II: Perspectives of Globalization (20 lectures)

- (a) Political Globalization: Globalization and Nation State; The Question of National Sovereignty and Territoriality
- (b) Economic Globalization: Political Economy and Globalization: Role of IMF, World Bank, WTO, TNCs
- (c) Cultural and Technological Globalization: Global Flows of Culture and its different Perspectives; Technological Dimension of Globalization

Unit III: Alternative Perspectives of Globalization (4 Lectures)

- (a) Global Resistances: Global Social Movements; Contemporary Global Civil Society

Unit IV: Contemporary Global Issues (25 lectures)

- (a) Environmental Issues: Historical Overview of International Environmental Agreements, Climate Change, Global Commons Debate
- (b) Proliferation of Nuclear Weapons
- (c) International Terrorism: Non-State Actors and State Terrorism; Post 9/11 developments
- (d) Migration
- (e) Human Security

Unit V. Global Shifts: Power and Governance (5 lectures)

- (a) Power: The Rise of the Global South?
- (b) Global Governance: Role of International and Regional organisations

READING LIST**I. Globalization – Conceptions and Perspectives Understanding Globalization and its Alternative Perspectives****Essential Readings:**

G. Ritzer, (2010) *Globalization: A Basic Text*, Sussex: Wiley-Blackwell, pp. 33-62.

M. Strager, (2009) *Globalization: A Very Short Introduction*, London: Oxford University Press, pp. 1-16.

R. Keohane and J. Nye Jr, (2000) 'Globalization: What's New? What's Not? (And So What?)', in *Foreign Policy*, No 118, pp. 104-119.

Additional Reading:

McGrew, (2011) 'Globalization and Global Politics', in J. Baylis, S. Smith and P. Owens (eds.) *Globalization of World*

Politics: An Introduction to International Relations, New York: Oxford University Press, pp. 14-31.

Heywood, (2011) *Global Politics*, New York: Palgrave-McMillan, pp. 1-24.

W. Ellwood, (2005) *The No-nonsense Guide to Globalization*, Jaipur: NI-Rawat Publications, pp. 12-23.

Political: Debates on Sovereignty and Territoriality

Essential Readings:

A. Heywood, (2011) *Global Politics*, New York: Palgrave-McMillan, pp. 112-134.

R. Keohane, (2000) 'Sovereignty in International Society', in D. Held and A. McGrew (eds.) *The Global Transformations*

Reader, Cambridge: Polity Press, pp. 109-123.

Additional Reading:

K. Shimko, (2005) *International Relations: Perspectives and Controversies*, New York: Houghton Mifflin, pp. 195-219.

Global Economy: Its Significance and Anchors of Global Political Economy: IMF, World Bank, WTO, TNCs

Essential Readings:

A. Heywood, (2011) *Global Politics*, New York: Palgrave-McMillan, pp. 454-479.

T. Cohn, (2009) *Global Political Economy: Theory and Practice*, pp. 130-140 (IMF), 208-218 (WTO).

R. Picciotto, (2003) 'A New World Bank for a New Century', in C. Roe Goddard et al., *International Political: State-Market Relations in a Changing Global Order*, Boulder: Lynne Rienner, pp. 341-351.

A. Narlikar, (2005) *The World Trade Organization: A Very Short Introduction*, New York: Oxford University Press, pp. 22-98.

J. Goldstein, (2006) *International Relations*, New Delhi: Pearson, pp. 392-405 (MNC).

P. Hirst, G. Thompson and S. Bromley, (2009) *Globalization in Question*, Cambridge: Polity Press, pp. 68-100 (MNC).

Additional Readings:

G. Ritzer, (2010) *Globalization: A Basic Text*, Sussex: Wiley-Blackwell, pp. 180-190.

F. Lechner and J. Boli (ed.), (2004) *The Globalization Reader*, London: Blackwell, pp. 236-239 (WTO).

D. Held et al, (1999) *Global Transformations: Politics, Economics and Culture*, California: Stanford University Press, pp. 242-282 (MNC).

T. Cohn, (2009) *Global Political Economy*, New Delhi: Pearson, pp. 250-323 (MNC).

Cultural and Technological Dimension

Essential Readings:

D. Held and A. McGrew (eds.), (2002) *Global Transformations Reader: Politics, Economics and Culture*, Cambridge: Polity

Press, pp. 1-50; 84-91.

M. Steger, (2009) 'Globalization: A Contested Concept', in *Globalization: A Very Short Introduction*, London: Oxford

University Press, pp. 1-16.

A. Appadurai, (2000) 'Grassroots Globalization and the Research Imagination', in *Public Culture*, Vol. 12(1), pp. 1-19.

Additional Reading:

J. Beynon and D. Dunkerley, (eds.), (2012) *Globalisation: The Reader*, New Delhi: Rawat Publications, pp. 1-19.

A. Vanaik, (ed.), (2004) *Globalization and South Asia: Multidimensional Perspectives*, New Delhi: Manohar Publications, pp.

171-191, 192-213, 301-317, 335-357.

Global Resistances (Global Social Movements and NGOs)

Essential Readings:

G. Ritzer, (2010) *Globalization: A Basic Text*, Sussex: Wiley-Blackwell, pp. 487-504.

R. O'Brien et al., (2000) *Contesting Global Governance: Multilateral Economic Institutions and Global Social Movements*, Cambridge: Cambridge University Press, pp. 1-23.

J. Fisher, (1998) *Non-Governments: NGOs and Political Development in the Third World*, Connecticut: Kumarian Press, pp. 1- 37 (NGO).

Additional Readings:

- G. Laxter and S. Halperin (eds.), (2003) *Global Civil Society and Its Limits*, New York: Palgrave, pp. 1-21.
 A. Heywood, (2011) *Global Politics*, New York: Palgrave-McMillan, pp. 150-156 (NGO).
 P. Willets, (2011) 'Trans-National Actors and International Organizations in Global Politics', in J. Baylis, S. Smith and P. Owens (eds.) *Globalization of World Politics*, New York: Oxford University Press, pp. 334-342. (NGO)

II. Contemporary Global Issues**Ecological Issues: Historical Overview of International Environmental Agreements, Climate Change, Global****Commons Debate****Essential Readings:**

- J. Volger, (2011) 'Environmental Issues', in J. Baylis, S. Smith and P. Owens (eds.) *Globalization of World Politics*, New York: Oxford University Press, pp. 348-362.
 A. Heywood, (2011) *Global Politics*, New York: Palgrave, pp. 383-411.
 N. Carter, (2007) *The Politics of Environment: Ideas, Activism, Policy*, Cambridge: Cambridge University Press, pp. 13-81.

Additional Readings:

- P. Bidwai, (2011) 'Durban: Road to Nowhere', in *Economic and Political Weekly*, Vol.46, No. 53, December, pp. 10-12.
 K. Shimko, (2005) *International Relations Perspectives and Controversies*, New York: Houghton-Mifflin, pp. 317-339.

Proliferation of Nuclear Weapons**Essential Readings:**

- D. Howlett, (2011) 'Nuclear Proliferation', in J. Baylis, S. Smith and P. Owens (eds.) *Globalization of World Politics*, New York: Oxford University Press, pp. 384-397.
 P. Viotti and M. Kauppi, (2007) *International Relations and World Politics: Security, Economy and Identity*, New Delhi: Pearson, pp. 238-272.

Additional Reading:

- A. Heywood, (2011) *Global Politics*, New York: Palgrave, pp. 264-281.

International Terrorism: Non-State Actors and State Terrorism; Post 9/11 developments**Essential Readings:**

- P. Viotti and M. Kauppi, (2007) *International Relations*, New Delhi: Pearson, pp. 276-307.
 Heywood, (2011) *Global Politics*, New York: Palgrave, pp. 282-301. Additional Readings:
 Kiras, (2011) 'Terrorism and Globalization', in J. Baylis, S. Smith and P. Owens (eds.) *Globalization of World Politics*, New York: Oxford University Press, pp. 366-380.
 Vanaik, (2007) *Masks of Empire*, New Delhi: Tulika, pp. 103-128.

Migration**Essential Readings:**

- G. Ritzer, (2010) *Globalization: A Basic Text*, Sussex: Wiley-Blackwell, pp. 298-322.
 S. Castles, (2012) 'Global Migration', in B. Chimni and S. Mallavarapu (eds.) *International Relations: Perspectives For the Global South*, New Delhi: Pearson, pp. 272-285.

Human Security**Essential Readings:**

- Acharya, (2011) 'Human Security', in J. Baylis, S. Smith and P. Owens (eds.) *Globalization of World Politics*, New York: Oxford University Press, pp. 480-493.
 Tadjbakhsh and A. Chenoy, (2007) *Human Security*, London: Routledge, pp. 13-19; 123-127; 236-243.

Additional Reading:

- Acharya, (2001) 'Human Security: East versus West', in *International Journal*, Vol. 56, no. 3, pp. 442-460.

III. Global Shifts: Power and Governance**Essential Readings:**

J. Rosenau, (1992) 'Governance, Order, and Change in World Politics', in J. Rosenau, and E. Czempiel (eds.) *Governance*

without Government: Order and Change in World Politics, Cambridge: Cambridge University Press, pp. 1-29.

A. Kumar and D. Messner (eds), (2010) *Power Shifts and Global Governance: Challenges from South and North*, London: Anthem Press.

P. Dicken, (2007) *Global Shift: Mapping the Changing Contours of the World Economy*, New York: The Guilford Press.

J. Close, (2001) 'The Global Shift: A quantum leap in human evolution', Available at <http://www.stir-global-shift.com/>

page22.php, Accessed: 19.04.2013

Semester V

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: PSC 151

Course Title: CLASSICAL POLITICAL PHILOSOPHY

Course objective:

This course goes back to Greek antiquity and familiarizes students with the manner in which the political questions were first posed. Machiavelli comes as an interlude inaugurating modern politics followed by Hobbes and Locke. This is a basic foundation course for students.

Unit I: Text and Interpretation (10 Lectures)

Unit II: Plato (10 Lectures)

Philosophy and Politics
Theory of Forms
Justice,
Philosopher King/Queen,
Communism

Unit III: Aristotle (10 Lectures)

Forms
Virtue
Citizenship
Justice
State and Household

Unit IV: Machiavelli (10 Lectures)

Virtue
Religion
Republicanism

Unit V: Possessive Individualism (10 Lectures)

Hobbes: Human Nature, State of Nature, Social Contract, State

Locke: Laws of Nature, Natural Rights, Property

READING LIST**I. Text and Interpretation****Essential Readings:**

T. Ball, (2004) 'History and Interpretation' in C. Kukathas and G. Gaus, (eds.) *Handbook of Political Theory*, London:

Sage Publications Ltd. pp. 18-30.

B. Constant, (1833) 'The Liberty of the Ancients Compared with that of the Moderns', in D. Boaz, (ed), (1997) *The*

Libertarian Reader, New York: The Free Press.

Additional Readings:

J. Coleman, (2000) 'Introduction', in *A History of Political Thought: From Ancient Greece to Early Christianity*, Oxford:

Blackwell Publishers, pp. 1-20.

Q. Skinner, (2010) 'Preface', in *The Foundations of Modern Political Thought Volume I*,

Cambridge: Cambridge University Press pp. ix-xv.

II. Antiquity: Plato**Essential Readings:**

A. Skoble and T. Machan, (2007) *Political Philosophy: Essential Selections*. New Delhi: Pearson Education, pp. 9-32.

R. Kraut, (1996) 'Introduction to the study of Plato', in R. Kraut (ed.) *The Cambridge Companion to Plato*. Cambridge:

Cambridge University Press, pp. 1-50.

C. Reeve, (2009) 'Plato', in D. Boucher and P. Kelly, (eds) *Political Thinkers: From Socrates to the Present*, Oxford: Oxford

University Press, pp. 62-80

Additional Readings:

S. Okin, (1992) 'Philosopher Queens and Private Wives', in S. Okin *Women in Western Political Thought*, Princeton:

Princeton University Press, pp. 28-50

R. Kraut, (1996) 'The Defence of Justice in Plato's Republic', in R. Kraut (ed.) *The Cambridge Companion to Plato*.

Cambridge: Cambridge University Press, pp. 311-337

T. Saunders, (1996) 'Plato's Later Political Thought', in R. Kraut (ed.) *The Cambridge Companion to Plato*. Cambridge:

Cambridge University Press, pp. 464-492.

Aristotle**Essential Readings:**

A. Skoble and T. Machan, (2007) *Political Philosophy: Essential Selections*. New Delhi: Pearson Education, pp. 53-64.

T. Burns, (2009) 'Aristotle', in D. Boucher, and P. Kelly, (eds) *Political Thinkers: From Socrates to the Present*. Oxford:

Oxford University Press, pp.81-99.

C. Taylor, (1995) 'Politics', in J. Barnes (ed.), *The Cambridge Companion to Aristotle*. Cambridge: Cambridge University

Press, pp. 232-258

Additional Readings:

J. Coleman, (2000) 'Aristotle', in J. Coleman *A History of Political Thought: From Ancient Greece to Early Christianity*, Oxford:

Blackwell Publishers, pp.120-186

D. Hutchinson, (1995) 'Ethics', in J. Barnes, (ed.), *The Cambridge Companion to Aristotle* Cambridge: Cambridge University Press, pp. 195-232.

III. Interlude:**Machiavelli****Essential Readings:**

Skoble and T. Machan, (2007) *Political Philosophy: Essential Selections*. New Delhi: Pearson Education, pp. 124-130

Skinner, (2000) 'The Adviser to Princes', in *Machiavelli: A Very Short Introduction*, Oxford: Oxford University Press, pp.

23-53

J. Femia, (2009) 'Machiavelli', in D. Boucher, and P. Kelly, (eds) *Political Thinkers: From Socrates to the Present*. Oxford:

Oxford University Press, pp. 163-184

Additional Reading:

Q. Skinner, (2000) 'The Theorist of Liberty', in *Machiavelli: A Very Short Introduction*. Oxford: Oxford University Press,

pp. 54-87.

IV. Possessive Individualism Hobbes**Essential Readings:**

A. Skoble and T. Machan, (2007) *Political Philosophy: Essential Selections*. New Delhi: Pearson Education pp. 131-157.

D. Baumgold, (2009) 'Hobbes', in D. Boucher and P. Kelly (eds) *Political Thinkers: From Socrates to the Present*. Oxford:

Oxford University Press, pp. 189-206.

C. Macpherson (1962) *The Political Theory of Possessive Individualism: Hobbes to Locke*. Oxford University Press, Ontario, pp.

17-29.

Additional Readings:

I. Hampsher-Monk, (2001) 'Thomas Hobbes', in *A History of Modern Political Thought: Major Political Thinkers from Hobbes*

to Marx, Oxford: Blackwell Publishers, pp. 1-67.

A. Ryan, (1996) 'Hobbes's political philosophy', in T. Sorell, (ed.) *Cambridge Companion to Hobbes*. Cambridge: Cambridge

University Press, pp. 208-245.

Locke**Essential Readings:**

A. Skoble and T. Machan, (2007) *Political Philosophy: Essential Selections*. New Delhi: Pearson Education, pp. 181-209.

J. Waldron, (2009) 'John Locke', in D. Boucher and P. Kelly, (eds) *Political Thinkers: From Socrates to the Present*. Oxford:

Oxford University Press, pp. 207-224

C. Macpherson, (1962) *The Political Theory of Possessive Individualism: Hobbes to Locke*. Oxford University Press, Ontario,

pp. 194-214.

Additional Readings:

R. Ashcraft, (1999) 'Locke's Political Philosophy', in V. Chappell (ed.) *The Cambridge Companion to Locke*, Cambridge:

Cambridge University Press, pp. 226-251.

I. Hampsher-Monk, (2001) *A History of Modern Political Thought: Major Political Thinkers from Hobbes to Marx*, Oxford:

Blackwell Publishers, pp. 69-116

Semester V

Course Code: PSC 152
Course Title: INDIAN POLITICAL THOUGHT-I

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objective:

This course introduces the specific elements of Indian Political Thought spanning over two millennia. The basic focus of study is on individual thinkers whose ideas are however framed by specific themes. The course as a whole is meant to provide a sense of the broad streams of Indian thought while encouraging a specific knowledge of individual thinkers and texts. Selected extracts from some original texts are also given to discuss in class. The list of additional readings is meant for teachers as well as the more interested students.

Indian Political Thought - I**Unit I: Traditions of Pre-colonial Indian Political Thought (12 Lectures)**

Brahmanic and Shramanic; Islamic and Syncretic

Unit II: Ancient Hindu Political Thought (12 Lectures)

Ved Vyasa: Rajdharmā

Manu: Social Laws

Unit III: Statecraft (12 Lectures)

Kautilya: State and Statecraft

Theory of State;

Unit IV: Buddhist and Syncretic Political Thought (12 Lectures)

Aggannasutta (Digha Nikaya): Theory of Kingship

Kabir: Syncretism

Unit V: Islamic Political Thought (12 Lectures)

Barani: Ideal Polity

Abul Fazal: Monarchy

READING LIST**I . Traditions of Pre-modern Indian Political Thought:****Essential Readings:**

B. Parekh, (1986) 'Some Reflections on the Hindu Tradition of Political Thought', in T. Pantham, and K. Deutsch

(eds.), *Political Thought in Modern India*, New Delhi: Sage Publications, pp. 17- 31.

A. Altekar, (1958) 'The Kingship', in *State and Government in Ancient India*, 3rd edition, Delhi: MotilalBanarsidass, pp.

75-108.

M. Shakir, (1986) 'Dynamics of Muslim Political Thought', in T. Pantham, and K. Deutsch (eds.), *Political Thought in*

Modern India, New Delhi: Sage Publications, pp. 142- 160

G. Pandey, (1978) *Sraman Tradition: Its History and Contribution to Indian Culture*,

Ahmedabad: L. D. Institute of Indology, pp. 52-73.

S. Saberwal, (2008) 'Medieval Legacy', in *Spirals of Contention*, New Delhi: Routledge, pp.1-31

II. VedVyasa (Shantiparva): Rajadharmā**Essential Readings:**

The Mahabharata (2004), Vol. 7 (Book XI and Book XII, Part II), Chicago and London: University of Chicago Press.

V. Varma, (1974) *Studies in Hindu Political Thought and Its Metaphysical Foundations*, Delhi: MotilalBanarsidass, pp. 211-

230.

B. Chaturvedi, (2006) 'Dharma-The Foundation of Raja-Dharma, Law and Governance', in

The Mahabharata: An Inquiry in the Human Condition, Delhi: Orient Longman, pp. 418- 464.

III. Manu: Social Laws**Essential Readings:**

Manu, (2006) 'Rules for Times of Adversity', in P. Olivelle, (ed. & trans.) *Manu's Code of Law: A Critical Edition and*

Translation of the Manava- Dharamsastra, New Delhi: OUP, pp. 208-213.

V. Mehta, (1992) 'The Cosmic Vision: Manu', in *Foundations of Indian Political Thought*, Delhi: Manohar, pp. 23-39.

R. Sharma, (1991) 'Varna in Relation to Law and Politics (c 600 BC-AD 500)', in *Aspects of Political Ideas and Institutions in Ancient India*, Delhi: MotilalBanarsidass, pp. 233- 251.

P. Olivelle, (2006) 'Introduction', in *Manu's Code of Law: A Critical Edition and Translation of the Manava – Dharmasastra*,

Delhi: Oxford University Press, pp. 3- 50.

IV. Kautilya: Theory of State**Essential Readings:**

Kautilya, (1997) 'The Elements of Sovereignty' in R. Kangle (ed. and trns.), *Arthasastra of Kautilya*, New Delhi: Motilal

Publishers, pp. 511- 514.

V. Mehta, (1992) 'The Pragmatic Vision: Kautilya and His Successor', in *Foundations of Indian Political Thought*, Delhi:

Manohar, pp. 88- 109.

R. Kangle, (1997) *Arthashastra of Kautilya-Part-III: A Study*, Delhi: MotilalBanarsidass, rpt., pp. 116- 142.

Additional Reading:

J. Spellman, (1964) 'Principle of Statecraft', in *Political Theory of Ancient India: A Study of Kingship from the Earliest time to*

Ceirca AD 300, Oxford: Clarendon Press, pp. 132- 170.

V. AggannaSutta (DighaNikaya): Theory of Kingship**Essential Readings:**

S. Collins, (ed), (2001) *AggannaSutta: An Annotated Translation*, New Delhi: Sahitya Academy, pp. 44-49.

S. Collins, (2001) 'General Introduction', in *AggannaSutta: The Discussion on What is Primary (An Annotated Translation*

fromPali), Delhi: *SahityaAkademi*, pp. 1- 26.

B. Gokhale, (1966) 'The Early *Buddhist* View of the State', in *The Journal of Asian Studies*, Vol. XXVI, (1), pp. 15-22.

Additional Reading:

L. Jayasurya, 'Budhism, Politics and Statecraft', Available at ftp.buddhism.org/Publications/.../Voll1_03_Laksiri%20Jayasuriya.pdf, Accessed: 19.04.2013.

VI. Barani: Ideal Polity**Essential Reading:**

I. Habib, (1998) 'ZiyaBarni's Vision of the State', in *The Medieval History Journal*, Vol. 2, (1), pp. 19- 36.

Additional Reading:

M. Alam, (2004) 'Sharia Akhlaq', in *The Languages of Political Islam in India 1200- 1800*,

Delhi: Permanent Black, pp. 26- 43

VII. AbulFazal: Monarchy**Essential Readings:**

A. Fazl, (1873) *The Ain-i Akbari*(translated by H. Blochmann), Calcutta: G. H. Rouse, pp. 47-57.

V. Mehta, (1992) 'The Imperial Vision: Barni and Fazal', in *Foundations of Indian Political Thought*, Delhi: Manohar, pp.

134- 156.

Additional Readings:

M. Alam, (2004) 'Sharia in NasereanAkhlaq', in *Languages of Political Islam in India1200-1800*, Delhi: Permanent Black,

pp. 46- 69.

I. Habib, (1998) 'Two Indian Theorist of The State: Barani and AbulFazal', in *Proceedings of the Indian History Congress*.

Patiala, pp. 15- 39.

VIII. Kabir: Syncreticism**Essential Readings:**

Kabir. (2002) *The Bijak of Kabir*, (translated by L. Hess and S. Singh), Delhi: Oxford University Press, No. 30, 97, pp.

50- 51 & 69- 70.

V. Mehta, (1992) *Foundation of Indian Political Thought*, Delhi: Manohar, pp. 157- 183.

G. Omvedt, (2008) 'Kabir and Ravidas, Envisioning Begumpura', in *Seeking Begumpura: The Social Vision of Anti Caste*

Intellectual, Delhi: Navayana, pp. 91- 107.

Additional Reading:

L. Hess and S. Singh, (2002) 'Introduction', in *The Bijak of Kabir*, New Delhi: Oxford University Press, pp. 3-35.

Semester VI

Course Code: PSC 161

Course Title: MODERN POLITICAL PHILOSOPHY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objective:

Philosophy and politics are closely intertwined. We explore this convergence by identifying four main tendencies here. Students will be exposed to the manner in which the questions of politics have been posed in terms that have implications for larger questions of thought and existence.

Unit I: Modernity and its Discourse (10 Lectures)

Introduction to the idea of Modernity

Discourses around Modernity

Processes and Characteristics of Modernity

Unit II: Romantics (16 Lectures)

Jean Jacques Rousseau: State of Nature, Social Contract, Origin of Inequality

Mary Wollstonecraft: Women and Paternalism, Education, Legal Rights

Unit III: Liberal Socialist: John Stuart Mill (10 Lectures)

Liberty

Subjection of Women

Utility Principle

Unit IV: Marxist Socialist: Karl Marx (10 Lectures)

Alienation

Historical Materialism

Class Struggle

Unit V: Feminist Socialist: Alexandra Kollontai (10 Lectures)

Winged and Wingless Eros

Socialization of Housework

The Woman Question

Reading List**I. Modernity and its discourses****Essential Readings:**

I. Kant. (1784) 'What is Enlightenment?', available at <http://theliterarylink.com/kant.html>, Accessed: 19.04.2013

S. Hall (1992) 'Introduction', in *Formations of Modernity* UK: Polity Press pages 1-16

II. Romantics**Essential Readings:**

B. Nelson, (2008) *Western Political Thought*. New York: Pearson Longman, pp. 221-255.

M. Keens-Soper, (2003) 'Jean Jacques Rousseau: The Social Contract', in M. Forsyth and M. Keens-Soper, (eds) *A*

Guide to the Political Classics: Plato to Rousseau. New York: Oxford University Press, pp. 171-202.

C. Jones, (2002) 'Mary Wollstonecraft's *Vindications* and their Political Tradition' in C. Johnson, (ed.) *The Cambridge*

Companion to Mary Wollstonecraft, Cambridge: Cambridge University Press, pp. 42-58.

S. Ferguson, (1999) 'The Radical Ideas of Mary Wollstonecraft', in *Canadian Journal of Political Science* XXXII (3), pp.

427-50, Available at <http://digitalcommons.ryerson.ca/politics>, Accessed: 19.04.2013.

III. Liberal Socialist**Essential Readings:**

H. Magid, (1987) 'John Stuart Mill', in L. Strauss and J. Cropsey, (eds), *History of Political Philosophy*, 2nd edition.

Chicago: Chicago University Press, pp. 784-801.

P. Kelly, (2003) 'J.S. Mill on Liberty', in D. Boucher, and P. Kelly, (eds.) *Political Thinkers: From Socrates to the Present*.

New York: Oxford University Press, pp. 324-359.

IV. Radicals**Essential Readings:**

J. Cropsey, (1987) 'Karl Marx', in L. Strauss and J. Cropsey, (eds) *History of Political Philosophy*, 2nd Edition. Chicago:

Chicago University Press, pp. 802-828.

L. Wilde, (2003) 'Early Marx', in D. Boucher and P. Kelly, P. (eds) *Political Thinkers: From Socrates to the Present*. New

York: Oxford University Press, pp. 404-435.

V. Bryson, (1992) 'Marxist Feminism in Russia' in *Feminist Political Theory*, London: Palgrave Macmillan, pp. 114-122

C. Synowich, (1993) 'Alexandra Kollontai and the Fate of Bolshevik Feminism' *Labour/Le Travail* Vol. 32 (Fall 1992) pp. 287-295

A. Kollontai (1909), *The Social Basis of the Woman Question*, Available at <http://www.marxists.org/archive/kollontai/1909/social-basis.htm>, Accessed: 19.04.2013

Additional Readings:

A. Bloom, (1987) 'Jean-Jacques Rousseau', in Strauss, L. and Cropsey, J. (eds.) *History of Political Philosophy*, 2nd edition.

Chicago: Chicago University Press, pp. 559-580.

Selections from *A Vindication of the Rights of Woman*, Available at <http://oregonstate.edu/instruct/phl302/texts/wollstonecraft/woman-a.html#CHAPTER%20II>, Accessed: 19.04.2013.

Skoble and T. Machan, (2007) *Political Philosophy: Essential Selections*, New Delhi: Pearson Education, pp. 328-

354.

Ollman (1991) *Marxism: An Uncommon Introduction*, New Delhi: Sterling Publishers.

G. Blakely and V. Bryson (2005) *Marx and Other Four Letter Words*, London: Pluto

Skoble, and T. Machan, (2007) *Political Philosophy: Essential Selections*, New Delhi: Pearson Education, pp. 286-327.

Kollontai, (1977) 'Social Democracy and the Women's Question', in *Selected Writings of Alexandra Kollontai*, London:

Allison & Busby, pp. 29-74.

Kollontai, (1977) 'Make Way for Winged Eros: A Letter to the Youth', in *Selected Writings of Alexandra Kollontai* Allison

& Busby, pp. 201-292.

C. Porter, (1980) *Alexandra Kollontai: The Lonely Struggle of the Woman who defied Lenin*, New York: Dutton Children's Books.

Semester VI

Course Code: PSC 162
Course Title: INDIAN POLITICAL THOUGHT-II

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course objective:

Based on the study of individual thinkers, the course introduces a wide span of thinkers and themes that defines the modernity of Indian political thought. The objective is to study general themes that have been produced by thinkers from varied social and temporal contexts. Selected extracts from original texts are also given to discuss in the class. The list of additional readings is meant for teachers as well as the more interested students.

Indian Political Thought - II**Unit I: Introduction to Modern Indian Political Thought (5 Lectures)**

Introduction

Major themes and issues

Unit II: Renaissance thinkers (12 Lectures)

Rammohan Roy: Rights

Vivekananda: Ideal Society

Rabindranath Tagore: Critique of Nationalism

Unit III: Gandhian thought (12 Lectures)

Swaraj

Satyagraha and Ahimsa

Religion and Politics

Unit IV: Social Justice (12 Lectures)

Pandita Ramabai: Gender and caste

Ambedkar: Social Justice

Unit V: Secular and Socialist thought (12 Lectures)

Nehru: Secularism

Lohia: Socialism

Reading List**I. Introduction to Modern Indian Political Thought****Essential Readings:**

V. Mehta and T. Pantham (eds.), (2006) *'A Thematic Introduction to Political Ideas in Modern India: Thematic Explorations,*

History of Science, Philosophy and Culture in Indian civilization'

Vol. 10, Part: 7, New Delhi: Sage Publications, pp. xxvii-ixi.

D. Dalton, (1982) *'Continuity of Innovation'*, in *Indian Idea of Freedom: Political Thought of Swami Vivekananda, Aurobindo*

Ghose, Rabindranath Tagore and Mahatma Gandhi,

Academic Press: Gurgaon, pp. 1-28.

II. Rammohan Roy: Rights**Essential Readings:**

R. Roy, (1991) *'The Precepts of Jesus, the Guide to Peace and Happiness'*, S. Hay, (ed.) *Sources of Indian Tradition,*

Vol. 2.

Second Edition. New Delhi: Penguin, pp. 24-29.

C. Bayly, (2010) *'Rammohan and the Advent of Constitutional Liberalism in India 1800-1830'*, in Sh. Kapila (ed.), *An intellectual History for India,* New Delhi: Cambridge University Press, pp. 18- 34.

T. Pantham, (1986) *'The Socio-Religious Thought of Rammohan Roy'*, in Th. Panthom and K. Deutsch, (eds.) *Political*

Thought in Modern India, New Delhi: Sage, pp.32-52.

Additional Reading:

S. Sarkar, (1985) 'Rammohan Roy and the break With the Past', in *A Critique on colonial India*, Calcutta: Papyrus, pp. 1-17.

III. Pandita Ramabai: Gender**Essential Readings:**

P. Ramabai, (2000) 'Woman's Place in Religion and Society', in M. Kosambi (ed.), *Pandita Ramabai Through her Own Words: Selected Works*, New Delhi: Oxford University Press, pp. 150-155.

M. Kosambi, (1988) 'Women's Emancipation and Equality: Pandita Ramabai's Contribution to Women's Cause', in

Economic and Political Weekly, Vol. 23(44), pp. 38-49.

Additional Reading:

U. Chakravarti, (2007) *Pandita Ramabai - A Life and a Time*, New Delhi: Critical Quest, pp. 1-40.

G. Omvedt, (2008) 'Ramabai: Women in the Kingdom of God', in *Seeking Begumpura: The Social Vision of Anti Caste*

Intellectuals, New Delhi: Navayana. pp. 205-224.

IV. Vivekananda: Ideal Society**Essential Readings:**

S. Vivekananda, (2007) 'The Real and the Apparent Man', S. Bodhasarananda (ed.), *Selections from the Complete Works of Swami Vivekananda*, Kolkata: Advaita Ashrama, pp. 126-129.

A. Sen, (2003) 'Swami Vivekananda on History and Society', in *Swami Vivekananda*, Delhi: Oxford University Press,

pp. 62- 79.

H. Rustav, (1998) 'Swami Vivekananda and the Ideal Society', in W. Radice (ed.), *Swami Vivekananda and the Modernisation of Hinduism*, Delhi: Oxford University Press, pp. 264-280.

Additional Reading:

Raghuramaraju, (2007) 'Swami and Mahatma, Paradigms: State and Civil Society', in *Debates in Indian Philosophy: Classical, Colonial, and Contemporary*, Delhi: Oxford University Press, pp. 29-65.

V. Gandhi: Swaraj**Essential Readings:**

M. Gandhi, (1991) 'Satyagraha: Transforming Unjust Relationships through the Power of the Soul', in S. Hay (ed.),

Sources of Indian Tradition, Vol. 2. Second Edition, New Delhi: Penguin, pp. 265-270.

A. Parel, (ed.), (2002) 'Introduction', in *Gandhi, freedom and Self Rule*, Delhi: Vistaar Publication.

D. Dalton, (1982) *Indian Idea of Freedom: Political Thought of Swami Vivekananda, Aurobindo Ghose, Mahatma Gandhi and*

Rabindranath Tagore, Gurgaon: The Academic Press, pp. 154- 190.

Additional Reading:

R. Terchek, (2002) 'Gandhian Autonomy in Late Modern World', in A. Parel (ed.), *Gandhi, Freedom and Self Rule*.

Delhi: Sage.

VI. Ambedkar: Social Justice**Essential Readings:**

B. Ambedkar, (1991) 'Constituent Assembly Debates', S. Hay (ed.), *Sources of Indian Tradition, Vol. 2, Second Edition*,

New Delhi: Penguin, pp. 342-347.

V. Rodrigues, (2007) 'Good society, Rights, Democracy Socialism', in S. Thorat and Aryama (eds.), *Ambedkar in*

Retrospect - Essays on Economics, Politics and Society, Jaipur: IIDS and Rawat Publications.

B. Mungekar, (2007) 'Quest for Democratic Socialism', in S. Thorat, and Aryana (eds.),

Ambedkar in Retrospect - Essays on Economics, Politics and Society, Jaipur: IIDS and Rawat Publications, pp. 121-142.

Additional Reading:

P. Chatterjee, (2005) 'Ambedkar and the Troubled times of Citizenship', in V. Mehta and Th. Pantham (eds.), *Political ideas in modern India: Thematic Explorations*, New Delhi: Sage, pp. 73-92.

VII. Tagore: Critique of Nationalism**Essential Readings:**

R. Tagore, (1994) 'The Nation', S. Das (ed.), *The English Writings of Rabindranath Tagore, Vol. 3*, New Delhi: Sahitya

Akademi, pp. 548-551.

R. Chakravarty, (1986) 'Tagore, Politics and Beyond', in Th. Panthams and K. Deutsch (eds.), *Political Thought in Modern India*, New Delhi: Sage, pp. 177-191.

M. Radhakrishnan, and Debasmita, (2003) 'Nationalism is a Great Menace: Tagore and Nationalism' in P. Hogan,

Colm and L. Pandit, (eds.) *Rabindranath Tagore: Universality and Tradition*, London: Rosemont Publishing and Printing

Additional Reading:

A. Nandy, (1994) 'Rabindranath Tagore & Politics of Self', in *Illegitimacy of Nationalism*, Delhi: Oxford University

Press, pp. 1-50.

VIII. Iqbal: Community**Essential Readings:**

M. Iqbal, (1991) 'Speeches and Statements', in S. Hay (ed.), *Sources of Indian Tradition, Vol. 2*, Second Edition, New

Delhi: Penguin, pp. 218-222.

A. Engineer, (1980) 'Iqbal's Reconstruction of Religious Thought in Islam', in *Social Scientist*, Vol.8 (8), pp. 52-63.

Madani, (2005) *Composite Nationalism and Islam*, New Delhi: Manohar, pp. 66-91.

Additional Reading:

L. Gordon-Polonsky, (1971) 'Ideology of Muslim Nationalism', in H. Malik (ed.), *Iqbal: Poet-Philosopher of Pakistan*,

New York: Columbia University Press, pp. 108-134.

IX. Savarkar: Hindutva**Essential Readings:**

V. Savarkar, 'Hindutva is Different from Hinduism', available at <http://www.savarkar.org/en/hindutva-essentialshindutva/>

hindutva-different-hinduism, Accessed: 19.04.2013

J. Sharma, (2003) *Hindutva: Exploring the Idea of Hindu Nationalism*, Delhi: Penguin, pp. 124-172.

Additional Reading:

Dh. Keer, (1966) *Veer Savarkar*, Bombay: Popular Prakashan, pp. 223-250.

X. Nehru: Secularism**Essential Readings:**

J. Nehru, (1991) 'Selected Works', in S. Hay (ed.), *Sources of Indian Tradition, Vol. 2*, Second Edition, New Delhi: Penguin,

pp. 317-319.

R. Pillai, (1986) 'Political thought of Jawaharlal Nehru', in Th. Pantham, and K. Deutsch (eds.), *Political Thought in*

Modern India, New Delhi: Sage, pp. 260- 274.

B. Zachariah, (2004) *Nehru*, London: Routledge Historical Biographies, pp. 169-213.

Additional Reading:

P. Chatterjee, (1986) 'The Moment of Arrival: Nehru and the Passive Revolution', in

Nationalist Thought and the Colonial World: A Derivative Discourse? London: Zed Books, pp. 131-166

XI. Lohia: Socialism**Essential Readings:**

M. Anees and V. Dixit (eds.), (1984) *Lohia: Many Faceted Personality*, RammanoharLohiaSmarakSmriti.

S. Sinha, (2010) 'Lohia's Socialism: An underdog's perspective', in *Economic and Political Weekly*, Vol. XLV (40) pp. 51-55.

A. Kumar, (2010) 'Understanding Lohia's Political Sociology: Intersectionality of Caste, Class, Gender and Language Issue', in *Economic and Political Weekly*, Vol. XLV (40), pp. 64-70.

Unit IV: Structural Violence and Human Rights (10 lectures)

- a. Caste and Race: South Africa and India
- b. Gender and Violence: India and Pakistan
- c. Adivasis/Aboriginals and the Land Question: Australia and India

V. Human Rights in India (10 lectures)

- (a) Evolution: Fundamental Rights (Part III), Directive Principles of State Policy (Part IV), Fundamental Duties (Part IV-A)
- (b) Human Rights of Disadvantaged Sections of Society: Scheduled Castes/Scheduled Tribes and Other Backward Classes, Minorities, Women and Children
- (c) Safeguards – NHRC, National Minority Commission, Women's Commission

Required Readings:

SAHRDC: Human Rights and Humanitarian Law: Developments in Indian and International Law, OUP: 2007.

2. P. Aston (ed): *The United Nations and Human Rights : A Critical Appraisal*, OUP.
 3. Gokulesh Sharma : *Human Rights and Legal Remedies*, Deep and Deep Publication, New Delhi.
 4. Upendra Baxi: *The Rights to be Human*, Lanner International, New Delhi.
 5. Arjun Dev Btal (ed.): *Human Rights: A Source Book*, New Delhi: NCERT
 6. Durga Das Basu: *Human Rights in Constitutional Law*, Prentice Hall of India, New Delhi
 7. S. Sharma *Children and Human Rights*, Commonwealth Publishers, New Delhi.
 8. Debi Chatterjee: *Human Rights: Theory and Practice*, South Asian Publishers, New Delhi.
 9. Pramod Misra: *Human Rights: Global Issues*. Kalpaz Publishers, New Delhi.
 10. Virendra Grover (ed). *Encyclopaedia of International Terrorism*, Deep and Deep Publications.
 11. A. U. Yasin and A. Upadhyay: *Human Rights*, Akansha Publishers, New Delhi, 2003.
 12. Myron Weiner: *The Child and the State in India*, OUP, New Delhi.
 13. R. Dhamala and S. Bhattacharjee (ed.): *Human Rights and Insurgency*, Shipra Publishers.
 14. R. Mullerson: *Human Rights Diplomacy*, Macmillan, London.
- R. J. Lincent: *Human Rights and International Relations*: CUP.

DISCIPLINE SPECIFIC ELECTIVE COURSE

Semester V

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: PSC 251**Course Title: HUMAN RIGHTS IN A COMPARATIVE PERSPECTIVES****Course objective:**

This course attempts to build an understanding of human rights among students through a study of specific issues in a comparative perspective. It is important for students to see how debates on human rights have taken distinct forms historically and in the contemporary world. The course seeks to anchor all issues in the Indian context, and pulls out another country to form a broader comparative frame. Students will be expected to use a range of resources, including films, biographies, and official documents to study each theme. Thematic discussion of sub-topics in the second and third sections should include state response to issues and structural violence questions.

Unit I: Human Rights: Concepts and Historical Development (15 lectures)

- (a) Rights: Meaning, Nature and Type
 - (i) Rights: inherent, inalienable, universal, indivisible
 - (ii) Values: Dignity, liberty, equality, justice, unity in diversity
- (b) Historical Development : Magna Carta, the British Bill of Rights, French and American Declarations

Unit II: Internationalisation of Human Rights (15 lectures)

Evolution of Human Rights on the International Plane

- (a) Institutionalization: Universal Declaration of Human Rights; Safeguards – International Conventions and Covenants
- (b) Groups- Woman, Child, Indigenous People, Minorities, Refugees

Unit III: Human Rights Organization and Movements (10 lectures)

- (a) NGOs and Human Rights Movements: Amnesty International Asia Watch, International Committee of Red Cross
- (b) Human Rights Movement: People's Union for Civil Liberties (PUCL), People's Union for Democratic Rights (PUDR) and other Civil and Democratic Rights Organisation in India.

Unit IV: Structural Violence and Human Rights (10 lectures)

- a. Caste and Race: South Africa and India
- b. Gender and Violence: India and Pakistan

Unit V: Human Rights in India (10 lectures)

- (a) Human Rights of Disadvantaged Sections of Society: Scheduled Castes/Scheduled Tribes and Other Backward Classes.
- (b) Safeguards – NHRC, National Minority Commission, Women's Commission

Required Readings:

- SAHRDC: Human Rights and Humanitarian Law: Developments in Indian and International Law, OUP: 2007.
2. P. Aston (ed): The United Nations and Human Rights : A Critical Appraisal, OUP.
 3. Gokulesh Sharma : Human Rights and Legal Remedies, Deep and Deep Publication, New Delhi.
 4. Upendra Baxi: The Rights to be Human, Lanner International, New Delhi.
 5. Arjun Dev Btal (ed.): Human Rights: A Source Book, New Delhi: NCERT
 6. Durga Das Basu: Human Rights in Constitutional Law, Prentice Hall of India, New Delhi
 7. S. Sharma Children and Human Rights, Commonwealth Publishers, New Delhi.
 8. Debi Chatterjee: Human Rights: Theory and Practice, South Asian Publishers, New Delhi.
 9. Pramod Misra: Human Rights: Global Issues. Kalpaz Publishers, New Delhi.
 10. Virendra Grover (ed). Encyclopaedia of International Terrorism, Deep and Deep Publications.
 11. A. U. Yasin and A. Upadhyay: Human Rightds, Akansha Publishers, New Delhi, 2003.
 12. Myron Weiner: The Child and the State in India, OUP, New Delhi.
 13. R. Dhamala and S. Bhattacharjee (ed.): Human Rights and Insurgency, Shipra Publishers.

Semester V**Course Code: PSC 252****Course Title: India's Foreign Policy in a Globalizing world****Course objective:**

This course's objective is to teach students the domestic sources and the structural constraints on the genesis, evolution and practice of India's foreign policy. The endeavour is to highlight integral linkages between the domestic and the international aspects of India's foreign policy by stressing on the shifts in its domestic identity and the corresponding changes at the international level. Students will be instructed on India's shifting identity as a postcolonial state to the contemporary dynamics of India attempting to carve its identity as an aspiring power. India's evolving relations with the superpowers during the Cold War and after, bargaining strategy and positioning in international climate change negotiations, international economic governance, international terrorism and the United Nations facilitate an understanding of the changing positions and development of India's role as a global player since independence.

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I: Foreign Policy**(12 Lectures)**

Determinants and Principles of Indian Foreign Policy
Non-Alignment to Aspiring Global Power

Unit II: India's Relations with the United States and Union of Soviet Socialist Republics/Russia (12 Lectures)

Unit III: India's Engagements with China and ASEAN (12 Lectures)

Unit IV: India in South Asia: Debating Regional Strategies (12 Lectures)

Unit V: India's Foreign Policy on: (12 Lectures)

Trade, Environment and Security Regimes
Reformation of the United Nations

READING LIST**I. India's Foreign Policy: From a Postcolonial State to an Aspiring Global Power****Essential Readings:**

- S. Ganguly and M. Pardesi, (2009) 'Explaining Sixty Years of India's Foreign Policy', in *India Review*, Vol. 8 (1), pp. 4-19.
- Ch. Ogden, (2011) 'International Aspirations of a Rising Power', in David Scott (ed.), *Handbook of India's International Relations*, London: Routledge, pp.3-31
- W. Anderson, (2011) 'Domestic Roots of Indian Foreign Policy', in W. Anderson, *Trusts with Democracy: Political Practice in South Asia*, Anthem Press: University Publishing Online.

Additional Reading:

- J. Bandhopadhyaya, (1970) *The Making Of India's Foreign Policy*, New Delhi: Allied Publishers.

II: India's Relations with the USA and USSR/Russia**Essential Readings:**

- S. Mehrotra, (1990) 'Indo-Soviet Economic Relations: Geopolitical and Ideological Factors', in *India and the Soviet Union: Trade and Technology Transfer*, Cambridge University Press: Cambridge, pp. 8-28.
- R. Hathaway, (2003) 'The US-India Courtship: From Clinton to Bush', in S. Ganguly (ed.), *India as an Emerging Power*, Frank Cass: Portland.
- A. Singh, (1995) 'India's Relations with Russia and Central Asia', in *International Affairs*, Vol. 71 (1): 69-81.
- M. Zafar, (1984), 'Chapter 1', in *India and the Superpowers: India's Political Relations with the Superpowers in the 1970s*, Dhaka, University Press.

Additional Readings:

- H. Pant, (2008) 'The U.S.-India Entente: From Estrangement to Engagement', in H. Pant, *Contemporary Debates in Indian Foreign and Security Policy: India Negotiates Its Rise in the International System*, Palgrave Macmillan: London.
- D. Mistry, (2006) 'Diplomacy, Domestic Politics, and the U.S.-India Nuclear Agreement', in *Asian Survey*, Vol. 46 (5), pp. 675-698.

III: India's Engagements with China**Essential Readings:**

- H. Pant, (2011) 'India's Relations with China', in D. Scott (ed.), *Handbook of India's International Relations*, London: Routledge, pp. 233-242.
- A. Tellis and S. Mirski, (2013) 'Introduction', in A. Tellis and S. Mirski (eds.), *Crux of Asia: China, India, and the Emerging Global Order*, Carnegie Endowment for International Peace: Washington.
- S. Raghavan, (2013) 'Stability in Southern Asia: India's Perspective', in A. Tellis and S. Mirski (eds.), *Crux of Asia: China, India, and the Emerging Global Order*, Carnegie Endowment for International Peace: Washington.

Additional Reading:

Li Li, (2013) 'Stability in Southern Asia: China's Perspective', in A. Tellis and S. Mirski (eds.), *Crux of Asia: China, India, and the Emerging Global Order*, Carnegie Endowment for International Peace: Washington.

IV: India in South Asia: Debating Regional Strategies**Essential Readings:**

S. Muni, (2003) 'Problem Areas in India's Neighbourhood Policy', in *South Asian Survey*, Vol. 10 (2), pp. 185-196.

S. Cohen, (2002) *India: Emerging Power*, Brookings Institution Press. V. Sood, (2009) 'India and regional security interests', in Alyssa Ayres and C. Raja Mohan (eds), *Power realignments in Asia: China, India, and the United States*, New

Delhi: Sage.

Additional Readings:

M. Pardesi, (2005) 'Deducing India's Grand Strategy of Regional Hegemony from Historical and Conceptual Perspectives', IDSS Working Paper, 76, Available at <http://www.rsis.edu.sg/publications/WorkingPapers/WP76.pdf>,

Accessed: 19.04.2013.

D. Scott, (2009) 'India's —Extended Neighbourhood Concept: Power Projection for a Rising Power', in *India Review*,

Vol. 8 (2), pp. 107-143

V: India's Negotiating Style and Strategies: Trade, Environment and Security Regimes**Essential Readings:**

S. Cohen, (2002) 'The World View of India's Strategic Elite', in S. Cohen, *India: Emerging Power*, Brookings Institution

Press, pp. 36-65.

A. Narlikar, (2007) 'All that Glitters is not Gold: India's Rise to Power', in *Third World Quarterly*, Vol. 28 (5) pp. 983 – 996.

N. Dubash, (2012) 'The Politics of Climate Change in India: Narratives of Enquiry and Co-benefits', Working Paper,

New Delhi: Centre for Policy Research.

N. Jayaprakash, (2000) 'Nuclear Disarmament and India', in *Economic and Political Weekly*, Vol. 35 (7), pp. 525-533.

Additional Readings:

P. Bidwai, (2005) 'A Deplorable Nuclear Bargain', in *Economic and Political Weekly*, Vol. 40 (31), pp. 3362-3364.

A. Anant, (2011) 'India and International Terrorism', in D. Scott (ed.), *Handbook of India's International Relations*, London: Routledge, pp. 266-277.

VI: India in the Contemporary Multipolar World**Essential Readings:**

R. Rajgopalan and V. Sahni (2008), 'India and the Great Powers: Strategic Imperatives, Normative Necessities', in

South Asian Survey, Vol. 15 (1), pp. 5–32.

C. Mohan, (2013) 'Changing Global Order: India's Perspective', in A. Tellis and S. Mirski (eds.), *Crux of Asia: China,*

India, and the Emerging Global Order, Carnegie Endowment for International Peace: Washington.

A. Narlikar, (2006) 'Peculiar Chauvinism or Strategic Calculation? Explaining the Negotiating Strategy of a Rising

India', in *International Affairs*, Vol. 82 (1), pp. 59-76.

Additional Reading:

P. Mehta, (2009) _Still Under Nehru's Shadow? The Absence of Foreign Policy Frameworks in India', in *India Review*,

Vol. 8 (3), pp. 209–233. Online Resources:

Government of India's Ministry of External Relations website at <http://www.mea.gov.in/> and specially its library

which provides online resources at <http://mealib.nic.in/>

The Council of Foreign Relations has a regularly updated blog on India's foreign policy: <http://www.cfr.org/region/>

india/ri282 Centre for Policy Research's blog on IR and strategic affairs though it is not exclusively on India's foreign

policy. <http://www.cprindia.org/blog/international-relations-and-security-blog>

Institute for Defence Studies and Analyses: <http://www.idsa.in/>

Research and Information System: www.ris.org.in/

Indian Council of World Affairs: www.icwa.in/ *Institute of Peace and Conflict Studies*: www.ipcs.org/

Indian Council for Research on International Economic Relations: www.icrier.org/

Semester VI

Course Code: PSC 261

Course Title: WOMEN, POWER AND POLITICS

Course objective:

This course opens up the question of women's agency, taking it beyond women's empowerment and focusing on women as radical social agents. It attempts to question the complicity of social structures and relations in gender inequality. This is extended to cover new forms of precarious work and labour under the new economy. Special attention will be paid to feminism as an approach and outlook.

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I: Patriarchy**(10 Lectures)**

Meaning and Concepts

Sex-Gender Debates

Public and Private

Unit II: Feminism**(24 Lectures)**

Meaning and Relevance; Waves of Feminism

Women and family

Women and community

Women and state

Unit III: History of the women's movement in India **(14 Lectures)****Unit IV: Violence against Women** **(6 Lectures)****Unit V: Work and Labour** **(14 Lectures)**

Visible and Invisible work

Sex Work

Reading List**I. Groundings****1. Patriarchy****Essential Readings:**

Shinde, (1993) _StreePurushaTulna', in K. Lalitha and Susie Tharu (eds), *Women Writing in India*, New Delhi, Oxford

University Press, pp. 221-234

Chakravarti, (2001) 'Pitrasatta Par ek Note', in S. Arya, N. Menon & J. Lokneeta (eds.) *Naarivaadi Rajneeti: Sangharshavam Muddey*, University of Delhi: Hindi Medium Implementation Board, pp.1-7

a. Sex Gender Debates

Essential Reading:

Geetha, (2002) *Gender*, Kolkata, Stree, pp. 1-20

b. Public and Private

Essential Reading:

Kosambi, (2007) *Crossing the Threshold*, New Delhi, Permanent Black, pp. 3-10; 40-46

c. Power

Essential Reading:

Menon, (2008) 'Power', in R. Bhargava and A. Acharya (eds), *Political Theory: An Introduction*, Delhi: Pearson, pp.148-157

2. Feminism

Essential Readings:

Hooks, (2010) 'Feminism: A Movement to End Sexism', in C. McCann and S. Kim (eds), *The Feminist Reader: Local and Global Perspectives*, New York: Routledge, pp. 51-57

R. Delmar, (2005) 'What is Feminism?', in W. Kolmar & F. Bartkowski (eds) *Feminist Theory: A Reader*, pp. 27-37

3. Family, Community and State a. Family

Essential Readings:

R. Palriwala, (2008) 'Economics and Patriliney: Consumption and Authority within the Household' in M. John. (ed)

Women's Studies in India, New Delhi: Penguin, pp. 414-423

b. Community

Essential Reading:

U. Chakravarti, (2003) *Gendering Caste through a Feminist Lens*, Kolkata, Stree, pp. 139-159.

c. State

Essential Reading:

C. MacKinnon, 'The Liberal State' from *Towards a Feminist Theory of State*, Available at <http://fair-use.org/catharinemackinnon/toward-a-feminist-theory-of-the-state/chapter-8>, Accessed: 19.04.2013.

Additional Readings:

K. Millet, (1968) *Sexual Politics*, Available at <http://www.marxists.org/subject/women/authors/millett-kate/sexualpolitics.htm>, Accessed: 19.04.2013.

N. Menon (2008) 'Gender', in R. Bhargava and A. Acharya (eds), *Political Theory: An Introduction*, New Delhi: Pearson, pp. 224-233

Hussain, (1988) 'Sultana's Dream', in *Sultana's Dream and Selections from the Secluded Ones – translated by RoushanJahan*, New York: The Feminist Press

Ray 'Understanding Patriarchy', Available at http://www.du.ac.in/fileadmin/DU/Academics/course_material/hrge_06.pdf, Accessed: 19.04.2013.

de Beauvoir (1997) *Second Sex*, London: Vintage.

Saheli Women's Centre, (2007) *Talking Marriage, Caste and Community: Women's Voices from Within*, New Delhi: monograph

II. Movements and Issues

1. History of Women's Movement in India

Essential Readings:

I. Agnihotri and V. Mazumdar, (1997) 'Changing the Terms of Political Discourse: Women's Movement in India, 1970s-1990s', *Economic and Political Weekly*, 30 (29), pp. 1869-1878.

R. Kapur, (2012) 'Hecklers to Power? The Waning of Liberal Rights and Challenges to Feminism in India', in A.

Loomba *South Asian Feminisms*, Durham and London: Duke University Press, pp. 333-355

2. Violence against Women

Essential Readings:

N. Menon, (2004) 'Sexual Violence: Escaping the Body', in *Recovering Subversion*, New Delhi: Permanent Black, pp. 106-165

3. Work and Labour

a. Visible and Invisible work

Essential Reading:

P. Swaminathan, (2012) 'Introduction', in *Women and Work*, Hyderabad: Orient Blackswan, pp.1-17

b. Reproductive and care work

Essential Reading:

J. Tronto, (1996) 'Care as a Political Concept', in N. Hirschmann and C. Stephano, *Revisioning the Political*, Boulder:

Westview Press, pp. 139-156

c. Sex work

Essential Readings:

DarbarMahilaSamanwaya Committee, Kolkata (2011) 'Why the so-called Immoral Traffic (Preventive) Act of India

Should be Repealed', in P. Kotiswaran, *Sex Work*, New Delhi, Women Unlimited, pp. 259-262

N. Jameela, (2011) 'Autobiography of a Sex Worker', in P. Kotiswaran, *Sex Work*, New Delhi: Women Unlimited, pp.

225-241

Additional Readings:

C. Zetkin, 'Proletarian Woman', Available at <http://www.marxists.org/archive/zetkin/1896/10/women.htm>, Accessed: 19.04.2013.

F. Engels, *Family, Private Property and State*, Available at <http://readingfromtheleft.com/PDF/EngelsOrigin.pdf>, Accessed: 19.04.2013.

J. Ghosh, (2009) *Never Done and Poorly Paid: Women's Work in Globalising India*, Delhi: Women Unlimited

Justice Verma Committee Report, Available at [http://nlrd.org/womens-rights-initiative/justice-verma-committee-reportdownload-](http://nlrd.org/womens-rights-initiative/justice-verma-committee-reportdownload-full-report)

full-report, Accessed: 19.04.2013.

N. Gandhi and N. Shah, (1992) *Issues at Stake – Theory and Practice in the Women's Movement*, New Delhi: Kali for Women.

V. Bryson, (1992) *Feminist Political Theory*, London: Palgrave-MacMillan, pp. 175-180; 196-200

M. Mies, (1986) 'Colonisation and Housewifisation', in *Patriarchy and Accumulation on a World Scale* London: Zed, pp. 74-

111, Available at

<http://caringlabor.wordpress.com/2010/12/29/maria-mies-colonization-and-housewifization/>, Accessed: 19.04.2013.

R Ghadially, (2007) *Urban Women in Contemporary India*, Delhi: Sage Publications.

S Brownmiller, (1975) *Against our Wills*, New York: Ballantine.

Saheli Women's Centre (2001) 'Reproductive Health and Women's Rights, Sex Selection and feminist response' in S

Arya, N. Menon, J. Lokneeta (eds), *NarivadiRajneeti*, Delhi, pp. 284-306

V. Bryson (2007) *Gender and the Politics of Time*, Bristol: Polity Press

Readings in Hindi:

D. Mehrotra, (2001) *BhartiyaMahilaAndolan: Kal, AajaurKal*, Delhi: Books for Change

G. Joshi, (2004) *Bharat Mein StreeAsmaanta: EkVimarsh*, University of Delhi: Hindi Medium Implementation Board

N. Menon (2008) 'Power', in R. Bhargava and A. Acharya (eds) *Political Theory: An Introduction*, New Delhi: Pearson

N. Menon (2008) 'Gender', in R. Bhargava and A. Acharya (eds) *Political Theory: An Introduction*, New Delhi, Pearson

R Upadhyay and S. Upadhyay (eds.) (2004) *AajkaStreeAndolan*, Delhi: ShabdSandhan.

S Arya, N. Menon and J. Lokneeta (eds.) (2001) *NaarivaadiRajneeti: SangbarshevamMuddey*

Semester VI

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: PSC 262

Course Title: SOCIETY AND POLITICS IN NAGALAND

Course Rationale

The paper introduces students to the traditional socio-political institutions of the Nagas in the pre-British era. Secondly, considerable emphasis is laid on the process of introduction of modern political institutions and institutional regulations by the British and the resultant institutional contradictions that led to the emergence of Naga national movement. Due importance is given to the study of the efficacy and relevance of traditional political institutions vis-a-vis contemporary politics in the aftermath of Nagaland statehood under the Indian union. Thirdly, local issues of politics and governance are to be studied within the framework of participatory democratic polity.

Unit 1: Traditional Socio-Political Institutions in Nagaland (10 lectures)

Political Institutions: Autocratic and Democratic Patterns,
Socio-political Institutions: *Morung*
Customary Laws and Practices

Unit II: British Regulations over the Naga Hills (20lectures)

Inner Line Regulations of 1873, Excluded and Partially excluded Regulations: Advantages and Disadvantages

Impact of British Rule in Nagaland: Administrative, Socio-Economic, Educational and Religious Spheres

Unit III: Naga Political Conflict and Peace Process(10 lectures)

Emergence and Factors of Naga Nationalism
Conflict and Peace Process in Nagaland

Unit IV: Politics in Nagaland (8 lectures)

The Creation of Nagaland State
Electoral Politics

Unit V: Rural Governance and Civil Society Organisations in Nagaland (12 lectures)

(a) Village Councils, VDBs and Communitisation

(b) Role of Civil Societies in Nagaland: NMA, Naga Hoho, NSF, Church

Basic Readings:

1. Lotha, Abraham, *History of Naga Anthropology (1832-1947)*, Chumpo Museum, Dimapur, 2007.
2. Angami, Z., *Village Empowering Laws: A Compilation*, Novelty Press, Kohima, 2008.
3. Longkumer, Jungmayangla, *Change and Continuity in Tribal Villages: A Sociological Study*, Akangsha Publishing House, New Delhi, 2009.
4. Nshoga, A., *Traditional Naga Village System and its Transformation*, Anshah Publishing House, Delhi, 2009.
5. Yonuo, Asoso, *The Rising Nagas*, Vivek Publishing House, New Delhi, 1974.
6. Sema, Piketo, *The British Policy and Administration in Nagaland (1881-1947)*, Scholar Publishing House, New Delhi, 1992.
7. Sema, Hokishe, *Emergence of Nagaland: Socio-Economic and Political Transformation*, Vikash Publishing House, New Delhi, 1986.
8. Chaube, S.K., *Hill Politics in North East India*, United Publishers, Gauhati, 2000.
9. Verrier, Elwin, *Nagas in the Nineteenth Century*, Shillong, 1969.

Suggested Readings:

1. Ao, Lanunungsang, *From Phizo to Muivah: The Naga National Question in North East India*, Mittal Publishers, New Delhi, 2004.
2. Shimray, A.S. Atai, *Let Freedom Ring: A Story of Naga Nationalism*, Promilla & Co., New Delhi, 2005.
3. Mackenzi, Alexander, *The North Frontier of India*, Mittal Publishers, New Delhi, 2001.
4. Ray, B. Datta and Agarwal, S.P., *Re-organisation of North East India since 1947*, Concept Publishing House, New Delhi, 1996.

5. Pakem B., *Insurgency in North East India*, United Publishers, Gauhati, 2000.
6. Singh, Chandrika, *Naga Politics: A Critical Account*, Mittal Publications, New Delhi, 2004.
7. Barpujari, H.K., *Problems of the Hill Tribes of North East India, Vol. 1, 2 and 3*, Prakashan, Hyderabad, 1976.
8. Bhattacharjee, K. K., *North East India: Political and Administrative History*, Cosmo publications, New Delhi, 1983.
9. Maitra, Kiranshankar, *The Naga Rebel and Insurgency*, United Publishers, Gauhati, 2000.
10. Horam, M., *Naga Insurgency: Last Thirty Years*, United Publishers, Gauhati, 2000.
11., *Naga Polity*, United Publishers, Gauhati, 2000.
12. Bhuyan, ManjulaDowereh, *The North Eastern Council*, DVS Publishers, 2005.
13. Ramunny, Murkot, *The World of Nagas*, Northern Book Centre, New Delhi, New Delhi, 1988.
14. Vashum, R., *Nagas' Right to Self-Determination*, Mittal Publishers, New Delhi, 2000.
15. Kumar, Ram Narayan & Murthy, Laxmi, *Four Years of the Ceasefire Agreement*, Other Media Communications, New Delhi.
16. Baruah, Sanjib (ed.), *Beyond the Impasse in North East India*, OUP, New Delhi, 2009. Counter Insurgency: Breaking
17., *Durable Disorder: Understanding the Politics of North East India*, OUP,
18. Hazarika, Sanjoy, *Strangers of the Mist*, Penguin, New Delhi, 1994.
19. Mishra, Udayon, *North East India: Quest for Identity*, United Publishers, Gauhati, 2000.
20. Anand, V.K., *Conflict in Nagaland: A Study of Insurgency and Counter- Insurgency*, Chanakya Publications, Delhi, 1980.
21. Pandey, R.S., *Communitisation: The Third Way of Governance*, Concept Publishing, New Delhi, 2010

SKILL ENHANCEMENT COURSE Semester III

Course Title: PSC 531

Course Title: YOUR LAWS, YOUR RIGHTS

Course Objective:

More often than not, when we talk of laws we mean authoritatively sanctioned rules, which are considered essential for a well-ordered society. Yet laws in a democracy are also about constituting a society marked by equality, freedom, and dignity. The rights approach to law has assumed importance in democracies, precisely because of people's struggles to broaden the understanding of law as something which reflects the will of the people. As such law becomes an important source of rights and duties, which develop and strengthen alongside institutions of representative democracy, constitutional norms, and the rule of law. This course aims to understand law as a source of rights, as a progressively widening sphere of substantive justice, welfare, and dignity. This relationship between laws and rights will be studied through specific values which have come to be seen as integral for a democratic society viz., equality and non-discrimination, empowerment, redistribution and recognition of traditional rights, etc.

| Credit : 2 | L - 2 | P - 0 | T - 0 |
|----------------|-------|-------|-------|
| Marks (CIA:ES) | 20:30 | - | - |

Unit I: Rule of Law and Criminal Justice System (15 Lectures)

- (a) Rule of Law and the Criminal Justice System in India
- (b) Law Relating to Criminal Justice Administration: Filing a complaint, FIR, Detention, Arrest and Bail

Unit II: Equality and Non-Discrimination (20 Lectures)

- (a) Gender: The Protection of Women against Domestic Violence, Rape and Sexual Harassment
- (b) Caste: Laws abolishing Untouchability, Protection against atrocities
- (c) Class: Laws concerning Minimum wages
- (d) Disability and Equality of Participation and Opportunity
- (e) Traditional Right of Forest Dwellers and the Issue of Women's Property Rights

Unit III: Access to identification, Documents and Social Security Schemes (5 Lectures)

- (a) Procedure for Obtaining Election Commission of India Identity Card, Driving License, Ration Card, Rastriya Swasthya Bima Yojana, Old-Age Pension Scheme

Readings**I. Rule of Law and the Criminal Justice System in India****Essential Readings:**

1. A. Andrew, (1996) 'Arbitrary Government and the Rule of Law', in *Arguing About the Law: An Introduction to Legal Philosophy*, Wordsworth, Boston, pp. 3-19.
2. SAHRD, (2006) 'Criminal Procedure and Human Rights in India' in *Oxford Handbook of Human Rights and Criminal Justice in India: The system and procedure*, New Delhi: Oxford University Press, pp. 5-15.
3. K. Sankaran and U. Singh, (2008) 'Introduction', in *towards Legal Literacy*, New delhil OUP, pp. xi-xv
4. B. Pandey, (2008) 'Laws relating to Criminal Justice: challenges and Prospects', in K. Sankaran and U. Singh, *Towards Legal Literacy*, New Delhil OUP, pp. 61-77.
5. SAHRD, (2006) 'Reporting a Crime: First Information Report' in *Oxford Handbook of Human Rights and Criminal Justice in India: The system and procedure*, New Delhi: Oxford University Press, pp. 16-26.
6. SAHRD, (2006) 'Bail' in *Oxford Handbook of Human Rights and Criminal Justice in India: The system and procedure*, New Delhi: Oxford University Press, pp. 59-71.
7. SAHRD, (2006) 'Detention' in *Oxford Handbook of Human Rights and Criminal Justice in India: The system and procedure*, New Delhi: Oxford University Press, pp. 72-84.
8. P. Mathew, (2003) *Your Rights if You are Arrested*, New Delhi, Indian Social Institute.

II. Equality and Non-Discrimination**Essential Readings:**

1. Gender Study Group, (1996) *Sexual Harassment in Delhi University: A Report*, Delhi: University of Delhi.
2. N. Jain, (2011) 'Physically/ Mentally Challenged' in M. Mohanty et al. *Weapon of the Oppressed: Inventory of People's Rights in India*, Delhi: Danish Books, pp. 171-179.
3. P. Matthew, (2002) *The Law on Atrocities Against Scheduled Castes and Scheduled Tribes*, New Delhi: Indian Social Institute.
4. P. Matthew, (2004) *The Minimum Wages Act, 1948*, New Delhi: Indian Social Institute.
5. K. Sankaran (2008) 'Labour Laws and the World of work', in K. Sankaran and U. Singh, *Towards Legal Literacy*, New Delhil OUP, pp. 119-131.
6. K. Saxena, (2011) 'Dalits' in M. Mohanty et al., *Weapon of the Oppressed, Inventory of People's Rights in India*. Delhi: Danish Books, pp. 15-38.
7. K. Saxena, (2011) 'Adivasis' in M. Mohanty et al., *Weapon of the Oppressed, Inventory of People's Rights in India*. Delhi: Danish Books, pp. 39-65.
8. S. Durrany, (2006) *The Protection of Women from Domestic Violence Act 2005*, New Delhi: Indian Social Institute.
9. V. Kumari, (2008) 'Offences Against Women', in K. Sankaran and U. Singh, *Towards Legal Literacy*, New Delhil OUP, pp. 119-131.
10. P.D. Matthew (2004) *The measure to Prevent Sexual Harassment of Women in Work Place*, New Delhi: Indian Social Institute.
11. D. Srivastava (2007) 'Sexual Harassment and Violence Against Women in India: Constitutional and Legal Perspectives' in C. Kumar and K. Chockalingam (eds) *Human Rights, Justice, and Constitutional Empowerment*, Delhi: OUP.

Unit III: Access to identification, Documents and Social Security Schemes**Essential Readings:**

1. N. Kurian, (2011) 'Consumers', in M. Mohanty et al., *Weapon of the Oppressed, Inventory of People's Rights in India*, Delhi: Danish Books
2. S. Naib, (2013) 'Right to Information Act 2005' in *The Right to Information in India*, New Delhi: OUP.
3. A. Roberts, (2010) 'A Great and Revolutionary Law: The First Four Year of India's Right to Information Act', *Public Administration Review*, Vol. 70, Issue 6, pp. 925-933.
4. SAHRDC, (2006), 'Consumer Rights', in *Introducing Human Rights*, OUP, pp. 118-134.
5. M. Sarin and O. Baginski, (2010) *India's Forest Rights Act: The Anatomy of a Necessary but not Sufficient Institutional Reform*, Department for International Development. Available at www.ippg.org.uk
6. J. Dreze, Dey and Khera, (2008) *Employment Guarantee Act: A Primer*, New Delhil National Book Trust

Semester IV

Course Code: PSC 541
Course Title: Peace and Conflict Resolution

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Course Objective:

The objective of an undergraduate application course for common students in Peace and Conflict Studies will cover in-depth knowledge of conflict analysis, conflict resolution, conflict prevention, as well as the historical and cultural context of organized violence. Peace and Conflict Resolution addresses the sources of war, social oppression and violence and the challenges of promoting peace and justice internationally and domestically. It also introduces more equitable, cooperative and nonviolent methods that can be used to transform unjust, violent or oppressive world situations. This course provides students with an overview of the Peace and Conflict Studies discipline, including key concepts and related theories. The course is designed to familiarize students with the historical background of various peace movements, to analyze principles used to resolve conflict, and to provide a view of how peace and conflict resolution are being pursued today. The course will also cover extensive understanding of current research and development within the field of peace and conflict studies and perspective of the environment, gender, migration, and ethnicity.

Unit I: Conflict and Conflict Analysis

- (a) Conflict: Concept, Causes and Sources of Conflict
- (b) Conflict Analysis: Methodology and Typology, Models developed by Peace and Conflict Resolution Theorists

Unit II: Conflict Resolution Concepts

- (a) Conflict Management, Conflict Resolution, Conflict Transformation
- (b) Concepts of Peace: Positive and Negative, Peace- Keeping, Peace Making and Peace Building

Unit III: Conflict Resolution Skills and Case Studies

- (a) Conflict Resolution Skills
- (b) Case Studies: Northern Ireland and Nagaland

Required Readings:**Unit I: Conflict and Conflict Analysis**

1. Azar, Edward, *The Management of Protracted Social Conflict: Theory and Cases* (Brookfield, VT: Dartmouth University Press, 1990)
2. Coleman, Peter, *Intractable Conflict*. In Morton Deutsch & Peter T. Coleman(Eds), *The Handbook of Conflict Resolution: Theory and Practice*. (San Francisco, CA: Jossey-Bass, 2000) pp.428-450.
3. Rothman, Jay, *Resolving Identity-Based Conflict in Nations, Organizations, and Communities* (San Francisco, CA: Jossey-Bass,1997)

Unit II: Conflict Resolution Concepts and Practice

1. Rasmussen & William I. Zartman (Eds), *Peacemaking in International Conflicts: Methods and Techniques*. (Herndon, VA: USIP Press,1997)
2. Lederach, John Paul. *Building Peace*. Washington DC : USIP Press, 1998.
3. Diamond, Louise and John McDonald. *Multi-Track Diplomacy: A Systems Approach to Peace*. Washington, D.C.: Institute for Multi-Track Diplomacy, 1993.
4. Boutros-Ghali, Boutros. *An Agenda for Peace*. New York: United Nations 1995
5. John Burton and Frank Dukes, *Conflict: Practices in Management, Settlement & Resolution*

Unit III: Conflict Resolution Skills and Case Studies

1. Peacemaking -- Overview" Conflict Management Toolkit. (Johns Hopkins University, School of Advanced International Studies, Conflict Management Program). accessed on 15 Feb. 2006. Available from <http://legacy2.sais-jhu.edu/cmtoolkit/approaches/peacemaking/index.htm>
2. SAIS, "The Conflict Management Toolkit: Approaches," The Conflict Management Program, Johns Hopkins University [available at: <http://www.sais-jhu.edu/resources/middle-east-studies/conflict-management-toolkit>
3. Henning Haugerudbraaten, "Peacebuilding: Six Dimensions and Two Concepts," Institute For Security Studies. [available at: <http://www.iss.co.za/Pubs/ASR/7No6/Peacebuilding.html>]
4. Luc Reyhler, "From Conflict to Sustainable Peacebuilding: Concepts and Analytical Tools," in *Peacebuilding: A Field Guide*, Luc Reyhler and ThaniaPaffenholz, eds. (Boulder, Colorado: Lynne Rienner Publishers, Inc., 2001)
5. John Paul Lederach, *Building Peace: Sustainable Reconciliation in Divided Societies*. (Washington, D.C., United States Institute of Peace, 1997), 75.
6. Michael Lund, "A Toolbox for Responding to Conflicts and Building Peace," In *Peace building:A Field Guide*, Luc Reyhler and ThaniaPaffenholz, eds. (Boulder, Colorado: Lynne Reinner Publishers, Inc., 2001), 18.
7. John Paul Lederach, *Building Peace: Sustainable Reconciliation in Divided Societies*. (Washington, D.C.: United States Institute of Peace Press, 1997.)

BACHELOR OF COMMERCE

B. COM HONOURS

| Semester | Core Course | Ability Enhancement Course | Skill Enhancement Course | Discipline Specific Elective Course | Generic Elective Course |
|---------------------------------|--|----------------------------|--------------------------|--|--|
| First | Financial Accounting (6) | Environmental Studies (2) | | | Consumer Affairs & Customer Care (6) |
| | Business Law (6) | | | | |
| Second | Management Principles & Applications (6) | Business Communication (2) | | | Fundamentals of Investment (6) |
| | Corporate Laws (6) | | | | |
| Third | Business Mathematics (6) | | E- Commerce (2) | | Financial Markets Institution & Financial Services (6) |
| | Income Tax Law & Practice (6) | | | | |
| | Human Resource Management (6) | | | | |
| Fourth | Indirect Taxes (6) | | Entrepreneurship (2) | | Organisational Behavior (6) |
| | Corporate Accounting (6) | | | | |
| | Computer Application in Business (6) | | | | |
| Fifth | Cost & Management Accounting (6) | | | Advertising (6) | |
| | Principles of Marketing (6) | | | Business Research Method & Project (6) | |
| Sixth | Financial Management (6) | | | International Business (6) | |
| | Auditing & Corporal Governance (6) | | | Business Statistics (6) | |
| No. of Courses (Credits) | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |

Semester I

Course Code: COM 111
Course Title: Financial Accounting

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objectives:

The objective of this paper is to help students to acquire conceptual knowledge of the financial accounting and to impart skills for recording various kinds of business transactions.

CONTENTS**Unit 1.****(a) Theoretical Framework 5 lectures**

Accounting as an information system, the users of financial accounting information and their needs. Qualitative characteristics of accounting, information. Functions, advantages and limitations of accounting. Branches of accounting: cash basis and accrual basis.

The nature of financial accounting principles- basic concepts and conventions: entity, money measurement, going concern, cost, realization accruals, periodicity, consistency, prudence (conservatism), materiality and full disclosures.

Financial accounting standards: concept, benefits, procedure for issuing accounting standards in India. International Financial Reporting Standards (IFRS):- need and procedures.

(b) Accounting Process 12 lectures

From recording of a business transaction to preparation of trial balance including adjustments: Manual and computerized accounting systems (computerized accounts by using any popular accounting software: creation of vouchers and recording transactions, preparing reports- cash book and bank book, ledger accounts, trial balance, profit and loss account (Income Statement) and Balance Sheet)

Unit 2.**(a) Business Income 10 lectures**

Measurement of business Income-Net income: the accounting period, the continuity doctrine and matching concept. Objectives of measurement.

Revenue recognition: salient features of Accounting Standard (AS): 9 (ICAI), recognition of expenses.

(b) Final Accounts 8 lectures

Capital and revenue expenditures and receipts: general introduction only. Preparation of financial statements of non-corporate business entities.

Unit 3.**Accounting for Hire Purchase and Installment Systems 10 lectures**

Concepts of operating and financial lease (theory with simple problems)

Unit 4.**Accounting for Inland Branches 10 lectures**

Concept of dependent branches; accounting aspects; debtors system, stock and debtors system, branch final accounts system and whole sale basis system. Independent branches: concept-accounting treatment: important adjustment entries and preparation of consolidated profit and loss account and balance sheet.

Unit 5.**Accounting for Dissolution of the Partnership Firm 10 lectures**

Accounting for dissolution of the partnership firm including Insolvency of partners, sale to a lim-

Suggested Readings:

1. Anthony, R.N. Hawkins, and Merchant. Accounting: Text and Cases. McGraw-Hill Education.
2. Horngren. Introduction to Financial Accounting. Pearson Education.
3. Shukla, M.C., T.S. Grewal and S.C. Gupta. Advanced Accounts. Vol.-I.S.Chand & Co., New Delhi.
4. Monga J.R. Financial Accounting: Concepts and Applications. Mayor Paper Backs, New Delhi.
5. Maheshwari, S.N. and S.K. Maheshwari. Financial Accounting. Vikas Publishing House, New Delhi.
6. Sehgal, Ashok and Deepak Sehgal. Advanced Accounting. Part-I. Taxmann Applied Services, New Delhi.
7. Bushan Kumar Goyal and HN Tiwari. Financial Accounting. International Book House.
8. Goldwin, Alderman and Sanyal. Financial Accounting. Cengage Learning.
9. Tulsian, P.C. Financial Accounting. Pearson Education.
10. Jain, S.P. and K.L. Narang. Financial Accounting. Kalyani Publishers, New Delhi.
11. Gupta, Nirmal. Financial Accounting. Sahitya Bhawan, Agra.
12. Compendium of Statements and Standards of Accounting. The Institute of Chartered Accounts of India, New Delhi.

Semester I

Course Code: COM 112
Course Title: Business Law

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

The objective of the course is to impart basic knowledge of the important business laws along with relevant case law.

CONTENTS**Unit 1: The Indian Contract Act, 1872: General Principle of Law of Contract. 13 lectures**

- Contract- meaning, characteristics and kinds.
- Essentials of valid contract- Offer and acceptance, consideration, contractual capacity, free consent, legality of objects.
- Void agreements.
- Discharge of contract- modes of discharge of contract including breach and its remedies.
- Contingent contracts.
- Quasi-contracts.

Unit II: The Indian Contract Act, 1872: Specific Contract 13 lectures

- Contract of Indemnity and Guarantee.
- Contract of Bailment.
- Contract of Agency.

Unit III: The Sale of Goods Act, 1930 13 lectures

- Contract of sale, meaning and difference between sale and agreement to sell.
- Conditions and warranties.
- Transfer of ownership in goods including sale by non-owners.
- Performance of contract of sale.
- Unpaid seller- meaning, rights of an unpaid seller against the goods and the buyer.

Unit IV: Partnership Laws 13 lectures**A. The Partnership Act, 1932**

- Nature and characteristics of Partnership.
- Registration of Firms.
- Types of Partners.
- Rights and duties of Partners.
- Implied authority of a Partner.
- Incoming and outgoing Partners.
- Mode of dissolution of Partnership.

B. The Limited Liability Partnership Act, 2008 (an overview)

- Salient features of LLP.
- Difference between LLP and partnership, LLP and company.
- LLP Agreement.
- Partners and Designated Partners.
- Incorporation Document.
- Incorporation by Registration.

Unit V: The Negotiable Instrument Act, 1881.

13 lectures

- Meaning and characteristics of Negotiable Instrument, Promissory Note, Bill of Exchange, Cheque.
- Holder and Holder in due course, privileges of Holder in due course.
- Negotiation: Types of Endorsement.
- Crossing of Cheque.
- Bouncing of Cheque.

Suggested Readings:

1. Kuchhal, M.C. and Vivek Kuchhal. Business Law. Vikas Publishing House, New Delhi.
2. Singh, Avta., Business La. Eastern Book company, Lucknow.
3. Maheshwari & Maheshwari. Business Law. National Publishing House, New Delhi.
4. Chadha, P.R.. Business Law. Galgotia Publishers Company, New Delhi.
5. Aggarwal, S.K. Business Law. Galgotia Publishers Company, New Delhi.
6. Goyal Bushan Kumar and Jain Kinneri. Business Laws. International Book House.
7. Ravindra Kumar. Legal Aspects of Business. Cengage Learning.

Semester II

Course code: COM 121
Course Title: Management Principles and Applications

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

The objective of the course is to provide the student with an understanding of basic management concepts, principles and practices.

CONTENTS**Unit I: Introduction****13 lectures**

- **Concept:** Need for study; Managerial functions- An overview; Coordination- Essence of Managership.
- **Evolution of Management Thought, Classical Approach-** Taylor, Fayol, Neo Classical Approach and Human Relations Approach- Mayo, Hawthorne Experiments, Behavioral Approach, Systems Approach, Contingency Approach- Lawrence & Lorsch, MBO- Peter F. Drucker, Re-engineering- Hammer and Champy, Micheal Porter- Five-force analysis, Three generic strategies and value chain analysis, Senge's learning Organization, Fortune at the Bottom of Pyramid- C.K. Prahalad.

Unit II: Planning**13 lectures**

- Types of plan- An overview to highlight the differences.
- Strategic planning- concept, process, importance and limitations.
- Environmental analysis and diagnosis (Internal and External environment)- Definition, importance and techniques (SWOT/TOWS/WOTS-UP, BCG Matrix, Competitor Analysis), Business Environment- Concept and components.
- Decision-making- Concept, Importance, Committee and group decision-making, Process, Perfect rationality and bounded rationality, Techniques (qualitative and quantitative, MIS, DSS).

Unit III: Organizing**13 lectures**

- Concept
- Process of organizing- An overview, Span of management, Different types of authority (line and staff and functional), Decentralization, Delegation.
- Formal and Informal structure.
- Principles of organizing.
- Network organization structure.

Unit IV: Staffing and Leading**13 lectures**

- Concept of staffing, an overview of staffing.
- Motivation- Concept, Importance, extrinsic and intrinsic motivation, Major motivation theories- Maslow's need hierarchy theory, Herzberg's Two-factor theory, Vroom's expectation theory.
- Leadership- Concept, Importance, Major theories of leadership- Likert's scale theory, Blake and Mouten's Grid theory, House's Path Goal theory, Fred Fielder's situational leadership; Transactional leadership, Transformational leadership, Transforming leadership.
- Communication- Concept, Purpose, Process, Oral and Written communication, Formal and Informal communication networks, Barriers to communication, Overcoming barriers to communication.

Unit V: Control**13 lectures**

- Concept, Process, Limitation, Principles of effective control, Major techniques of control- Ratio analysis (ROI), Budgetary control, EVA, MVA, PERT/CPM.
- Emerging issues in management.

Suggested readings:

1. Harold Koontz and Heinz Weihrich. Essentials of Management. Pearson Education.
2. Stephen Robbins and M. Coulter. Management. Pearson Education.
3. Stephen P Robbins, David A Decenzo, Sanghmitra Bhattacharya and Madhushree Manda Agrawal. Fundamentals of Management, Essentials, Concepts and Applications. Pearson Education.
4. Drucker Peter F. Practice of Management. Mercury Books, London.
5. George Terry. Principles of Management. Richard D Irwin.
6. Newman Summer and Gilbert. Management. PHI.
7. James h Donnelly. Fundamentals of Management. Pearson Education.
8. Chhabra, T.N. Essentials of Management. Sun India.
9. Griffin. Management Principles and Application. Cengage Learning.
10. Robert krietner. Management Theory and Application. Cengage Learning.

Semester II

Course code: COM 122
Course Title: CORPORATE LAWS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

The objective of the course is to impart basic knowledge of the provisions of the Companies Act 2013 and the Depositories Act, 1996. Case studies involving issues in corporate laws are required to be discussed.

CONTENTS**UNIT I****15 lectures**

Introduction- Administration of Company Law [including National Company Law Tribunal (NCLT), National Company Law Appellate Tribunal (NCLAT), Special Courts]; Characteristics of a company; lifting of corporate veil; types of companies including one person company, small company, dormant company and producer company; association not for profit; illegal association; formation of company, on-line filling of documents, promoters, their legal position, pre-incorporate contract and provisional contracts; on-line registration of accompany.

UNIT II**15 lectures**

Documents- Memorandum of association, articles of association, doctrine of constructive notice and indoor management prospector-shelf and red herring prospectus, misstatement in prospectus, GDR; book building; issue, allotment and forfeiture of share, transmission of shares, buyback and provisions regarding buyback; issue of bonus shares.

UNIT III**15 lectures**

Management- classification of directors, women directors, independent director, small shareholder's director; disqualifications, director identity number (DIN); appointment; Legal positions, powers and duties; removal of directors; Key managerial personnel, managing director, manager; meeting of shareholders and board; types of meeting, convening and conduct of meetings, postal ballot, meeting through video conferencing, e-voting. Committees of Board of Directors-Audit Committee, Nomination and Remuneration Committee, Stakeholders Relationship Committee, Corporate Social Responsibility Committee.

UNIT IV**15 lectures**

Dividends, Accounts, Audit- Provisions relating to Dividend, Provisions relating to Books of Account, Provisions relating of Audit, Auditors' Appointment, Rotation of Auditors, Auditors' Report, Secretarial Audit.

Winding up- Concept and modes of Winding Up.

Insider Trading, Whistle Blowing- Insider Trading; meaning & legal provisions; Whistle- blowing: Concept and Mechanism.

UNIT V**5 lectures**

Depositories Law: The Depositories Act 1996- Definitions; rights and obligations of depositories; participant's issuers and beneficial owners; inquiry and inspections, penalty.

Suggested readings:

1. MC Kuchhal. Corporate Laws. Shri Maheveer Book Depot. (Publishers).
2. GK Kapoor & Sanjayn Dhamija. Company Law. Bharat Law House.
3. Reena Chadha ans Sumant Chadha. Corporate Laws. Scholar Tech Press.
4. Gowar, LCB. Principle of Modrn Company Law. Stevens & Sons, London.
5. Ramaiya. A Guide to Companies Act, LexisNexis, Wadhwa and Buttersworth.
6. A Compendium of Companies Act 2013, along with Rules, by Tamann Publications.
7. Avtar Singh. Introduction to Company Law. Eastern Book Company.

Semester III

Course code: COM 131
Course Title: Business Mathematics

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

The objective of this course is to familiarize the students with the basic mathematical tools with emphasis on applications to business and economic situations.

CONTENTS**Unit I: Matrices and Determinants****11 lectures**

- Algebra of matrices, Inverse of a matrix, Matrix operation- Business application
- Solution of system of linear equations (having unique solution and involving not more than three variables) using matrix inversion method and Cremer's Rule, The Leontief Input Output Model (Open Model only).

Unit II: Calculus I**10 lectures**

- Mathematical functions and their types- linear, quadratic, polynomial, exponential, logarithmic and logistic function, Concepts of limit and continuity of a function.
- Concept and rules of differentiation, Maxima and Minima involving second or higher order derivatives.
- Concept of Marginal analysis, Concept of elasticity, Applied Maximum and Minimum problems including effect of tax on Monopolist's optimum price and quantity, Economic Order Quantity.

Unit III: Calculus II**17 lectures**

- Partial Differentiation- Partial derivatives up to second order, Homogeneity of functions and Euler's theorem, Total differentials- Differentiation of implicit functions with the help of total differentials.
- Maxima and Minima in cases of two variables involving not more than one constraint including the use of the Lagrangean multiplier.
- Integration, Standard forms, Methods of integration- by substitution, by parts and by use of partial fractions, Definite integration, Finding areas in simple cases.
- Application of integration to marginal analysis, Consumer's and Producer's surplus, Rate of Sales and Learning curve.

Unit IV: Mathematics of Finance**10 lecturers**

- Rates of interest-nominal, effective and their inter-relationships in different compounding situations.
- Compounding and discounting of a sum using different types of rates.
- Types of annuities- ordinary, due, deferred, continuous, perpetual and their future and present values using different types of rates of interest, Depreciation of assets.

Unit V: Linear Programming**17 lecturers**

- Formulation of linear Programming Problems (LPP), Graphical solution to LPPs, Cases of unique and multiple optimal solutions, Unbounded solutions and infeasibility, Redundant constraints.
- Solution to LPPs using Simplex method-maximization and minimization cases, Shadow prices of the resources, Identification of unique and multiple optimal solutions, unbounded solution, infeasibility and degeneracy.

Note: In addition, the students will work on a software package for solving linear programming problems and analyze the results obtained there from. This will be done

Suggested Readings:

1. Anthony, M. and N. Biggs. Mathematics for Economics and Finance. Schaum's University Press.
2. Ayres, Frank Jr. Theory and Problems of Mathematics of Finance. Schaum's University Press.
3. Budnick, P. Applied Mathematics. McGraw Hill Publishing Co.
4. Dowling, E.T. Mathematics for Economics. Schaum's Outlines Series. McGraw Publishing Co.
5. Mizrahi and John Sullivan. Mathematics for Business and Social Sciences. Wiley and Sons.
6. Wikes, F.M. Mathematics for Business, Finance and Economics. Thomson Learning.
7. Prasad, Bindra and P.K. Mittal. Fundamentals of Business Mathematics. Har-Anand Publications.
8. Thukral, J.K. Mathematics for Business Studies. Mayur Publications.
9. Vohra, N.D. Quantitative Techniques in Management. Tata McGraw Hill Publishing Co.
10. Soni, R.S. Business Mathematics. Pitambar Publishing House.
11. Singh, J.K. Business Mathematics. Himalaya Publishing House.

Semester III**Course code: COM 132****Course Title: Income Tax Law and Practice**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

To provide basic knowledge and equip students with application of principles and provisions of Income Tax Act, 1961.

CONTENTS**Unit I: Basic Concept****13 lectures**

- Income, Agricultural Income, Person, Assessee, Assessment Year, Previous Year, Gross Total Income, Total Income, Maximum Marginal Rate of Tax.
- Permanent Account Number (PAN)
- Residential status- Scope of total income on the basis of residential status.
- Exempted income under section 10.

Unit II: Computation of income under different heads**20 lectures**

- Salaries
- Income from House Property.

Unit III: Computation of income under different heads**12 lectures**

- Profits and gains of business or professions
- Capital Gains
- Income from other sources

Unit IV: Total income and tax computation**17 lectures**

- Income of other persons included in assessee's total income
- Aggregation of income and set-off and carry forward of losses
- Deductions from gross total income
- Rebates and reliefs
- Computation of total income of individuals and firms- tax liability of an individual and firm, Five leading cases of Supreme Court.

Unit V: Preparation of return of income**13 lecturers**

- Manually
- On-line filing of returns of income & TDS
- Provision & procedures of compulsory On-line filing of returns for specified assesses.

Note: *There shall be a practical examination of 20 marks on E-filing of Income Tax Returns using a software utility tool. The student id required to fill appropriate form and generate the XML file.*

Suggested readings:

1. Singhania, Vinod K. and Monica Singhania. Students' Guide to Income Tax, University Edition. Taxmann Publications Pvt.Ltd., New Delhi.
2. Ahuja, Girish and Ravi Gupta. Systematic Approach to Income Tax. Bharat Law House, Delhi.
3. Pagare, Dinkar. Law and Practice of Income Tax. Sultan Chand and Sons, New Delhi.
4. Lal, B.B. Income Tax Law and Practice. Konark Publications, New Delhi.
- 5. Journals**
6. Income Tax Reports. Company law Institute of India Pvt.Ltd., Chennai.
7. Taxman. Taxman Allied Services Pvt. Ltd., New Delhi.
8. Current Tax Report. Current Tax Reporter, Jodhpur.
- 9. Software**
10. Dr. Vinod Kumar Singhania, e-filing of Income Tax Returns and Computation of Tax, Taxmann Publication Pvt. Ltd., New Delhi. Latest version.
11. Excel Utility available at incometaxindiaefiling.gov.in.

Semester III

Course code: COM 133
Course Title: Human Resource Management

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

The objective of this study is to familiarize the students with the basic concept of human resource management and its usefulness and importance in the business environment.

CONTENTS**Unit I: Human Resource Management****13 lectures**

Concept and functions, Role, Status and competencies of HR manager, HR policies, Evolution of HRM, Emerging challenges of human resource management, Workforce diversity, Empowerment, Downsizing, VRS, Human resource information system.

Unit II: Acquisition of Human Resource**13 lectures**

Human resource planning- Quantitative and Qualitative dimensions, Job Analysis- Job description and job specification, Recruitment- Concept and sources, Selection- Concept and process, Test and interview, Placement induction.

Unit III: Training and Development**13 lectures**

Concept and importance, Identifying training and development needs, Designing training programmes, Role specific and Competency Based Training, Evaluating training effectiveness, Training process outsourcing, Management development, Career development.

Unit IV: Performance Appraisal**13 lectures**

Nature and objectives, Modern techniques of performance appraisal, Potential appraisal and employee counseling, Job changes- Transfers and promotions, Compensation- concept and policies, Job evaluation, Methods of wage payments and incentive plans, Fringe benefits, Performance linked compensation.

Unit V: Maintenance**13 lectures**

Employee health and safety, Employee welfare, Social Security, Employer-Employee relations- an overview, Grievance handling and redressal Industrial Disputes cases and settlement machinery.

Suggested Readings:

1. Gary Dessler. A framework for Human Resource Management. Pearson.
2. DeCenzo, D.A. and S.P. Robbins. Personnel/Human Resource Management. Prentice Hall of India, New Delhi.
3. Bohlendar and Snell, Principles of Human Resource Management, Cengage Learning.
4. Chhabra, T.N. Essentials of Human Resource Management, Sun India Publication, New Delhi.
5. Ivancevich, John M. Human Resource Management. McGraw Hill.
6. Wreather and Davis, Human Resource Management, Pearson Education.
7. Robert L.Mathis and John H.Jackson. Human Resource Management. Cengage Learning.

Semester IV

Course code: COM 141
Course Title: Indirect Taxes

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Title: Indirect Taxes**Credit: 6**

Objective: To provide basic knowledge and equip students with application of principles and provisions of Service Tax ,GST, Central Excise and Custom Laws.

CONTENTS**Unit I: Service Tax****15 lectures**

Concepts and general principles, charge of service tax and taxable services, valuation of taxable services, payment of service tax and filing of returns, penalties, CENVAT Credit.

Unit II: Goods and Services Tax, 2017**15 lectures**

Preliminary, Administration, Levy and collection of tax, Registration, Taxes under GST- CGST, SGST,IGST,UTGST(including latest amendments to the GST Act).

Unit III: Central Excise**10 lectures**

Central Excise law in brief-Goods, Excisable goods, Manufacture and manufacture, valuation, CENVAT- basic procedures, Export, SSI, Job Work.

Unit IV: Customs Law**15 lectures**

Basic concepts of customs law, Territorial waters, High Seas, Types of custom Laws-Basic, Countervailing & Anti-Dumping Duty, Safeguard Duty, Valuation, Customs procedures, Import and Export Procedures, Baggage, Exemptions.

Unit V: Central Sales Tax**10 lectures**

Nature and scope of CST (including latest amendment), Sales/Purchase in the course of imports and exports out of India.

Suggested Readings:

- 1.Singhania Vinod K. And Monica Singhania. Student's Guide to Indirect Taxes. Taxmann Publications Pvt. Ltd, Delhi
2. V.S Datey, Indirect Tax Law and Practice. Taxmann Publications Pvt. Ltd, Delhi
3. Sanjeev Kumar, Systematic Approach to Indirect Taxes, Latest Edition.
4. S.S.Gupta, Service Tax- How to meet your obligation. Taxmann Publications Pvt. Ltd, Delhi, Latest Edition.
5. Girish Ahuja & Dr. Ravi Gupta, Indirect Taxes, Flair Publication Pvt. Ltd.

Semester IV

Course code: COM 142
Course Title: Corporate Accounting

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

To help the students to acquire the conceptual knowledge of the corporate accounting and to learn the techniques of preparing the financial statements.

CONTENTS**Unit I: Accounting for Share Capital and Debentures** **15 lectures**

Issue, forfeiture and reissue of forfeited shares- concept and process of book building, Issue of rights and bonus shares, Buy back of shares, Redemption of preference shares, Issue and redemption of debentures.

Unit II: Final Accounts and Valuation of Goodwill and Shares **12 lectures**

Preparation of Profit and Loss Account and Balance Sheet of corporate entities excluding calculation of managerial remuneration, Disposal of company profits.

Valuation of Goodwill and Valuation of Shares- concepts and calculations (simple problems only).

Unit III: Amalgamation of Companies **12 lectures**

Concepts and accounting treatment as per Accounting Standard:14 (ICAI) excluding inter company accounts, Internal reconstruction- concepts and accounting treatment excluding scheme of reconstruction.

Unit IV: Accounts of Holding Companies/Parent Companies/Banking Companies**19 lectures**

Preparation of consolidated balance sheet with one subsidiary company, Relevant provisions of Accounting Standard: 21 (ICAI), Difference between balance sheet of banking and non-banking company, Prudential norms, Asset structure of a commercial bank, Non-performing assets (NPA).

Unit V: Cash Flow Statement **7 lectures**

Concepts of funds, preparation of cash flow statement as per Accounting Standard (AS): 3 (Revised) (ICAI): Indirect method only.

Suggested Readings:

1. Jain, S.P. and K.L. Narang. Advanced Accountancy II. Klayani Publishers.
2. Shukla, M.C., T.S. Grewal and S.C. Gupta. Advanced Accounts. Vol-II. S.Chand & Co., New Delhi.
3. Maheshwari, S.N., and S.K. Maheshwari. Financial Accounting. Vikas Publishing House, New Delhi.
4. Tulsian P.C. Financial Accounting. Pearson Education.
5. Paul Kumar, S. Advanced Accountancy. Vol-II. New Central Book Agency Pvt. Ltd.

Semester IV

Course code: COM 143
Course Title: Computer Application in Business

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

To provide computer skills and knowledge for commerce students and to enhance the student understands of usefulness of information technology tools for business operations.

CONTENTS**Unit I: Word Processing****7 lectures**

Introduction to word processing, Word processing concepts, Use of templates, Working with word document (opening an existing document/creating a new document, saving, selecting text, editing text, finding and replacing text, closing, formatting, checking and correcting spellings)

Bullets and numbering, Tabs, Paragraph formatting, Indent, Page formatting, Header and Footer, Mail merge including linking with access database, Tables- formatting the table, inserting filling and formatting a table.

Creating documents in the areas- mail merge including linking with access database, Handling tables, Inserting pictures and video.

Unit II: Preparing Presentations**6 lectures**

Basics of presentations- Slides, Fonts, Drawing, Editing; Inserting- Tables, Images, Texts, Symbols, Media; Design; Transition; Animation; Slideshow.

Unit III: Spreadsheet and its Business Application**16 lectures**

Spreadsheet concepts, Creating a work book, Saving a work book, Editing a work book, Inserting, Deleting work sheets, Entering data in a cell, Formula copying, Moving data from selected cells, Handling operators in formula, Rearranging worksheet, Project involving multiple spreadsheets, Organizing charts and graphs, printing worksheet.

Generally used spreadsheet functions- Mathematical, Statistical, Financial, Logical, Data and Time, Lookup and reference, Text functions.

Unit IV: Creating spreadsheet in the following areas**16 lectures**

- Loan and Lease statement
- Ratio Analysis
- Payroll statements
- Capital Budgeting
- Graphical representation of data
- Frequency distribution and its statistical parameters
- Correlation and Regression

Unit V: Database Management System**20 lectures**

Creating data tables, Editing a database using Forms, performing queries, Generating reports, Creating DBMS in the areas of accounting, Employees, Suppliers and Customer.

Notes:

- The General Purpose Software referred to in this course will be notified by the University Departments every three years. If the specific features, referred in the detailed course above is not available in that software to that extent it will be deemed to have been modified.
- There shall be a practical examination of 100 marks (Practical-70 marks, Viva-10 marks and Work Book-20 marks) and the duration of examination shall be 3 hours.

Semester V

Course code: COM 151
Course Title: Cost and Management Accounting

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

To acquaint the students with basic concepts used in cost and management accounting and various methods involved in cost ascertainment systems.

Unit I: Introduction**6 lectures**

Meaning, objectives and advantages of cost accounting; Difference between cost, financial and management accounting; Cost concepts and classifications; Role of a cost accountant in an organization.

Unit II: Elements of Cost**13 lectures**

Materials: material/inventory control- concept and techniques, Accounting and control of purchases, Storage and issue of materials; Methods of pricing of materials issues- FIFO, LIFO, Simple Average, Weighted Average, Replacement, Standard, Treatment of material losses.

Labor: Accounting and control of labor cost, Time keeping and time booking, concept and treatment of idle time, over time, labor turnover and fringe benefits.

Overhead: Classification, allocation, apportionment and absorption of overhead, Under-and over-absorption, Capacity costs, Treatment of certain items in costing like interest on capital, packing expenses, debts, research and development expenses, Bad activity- based cost allocation.

Unit III: Methods of Costing**13 lectures**

Unit costing, Job costing, Contract costing, Process costing (process losses, valuation of work in progress, joint and by-products), Service costing (only transport), Accounting systems: Integral and non-integral systems, Reconciliation of cost and financial accounts.

Unit IV: Budgeting and Budgetary Control, Standard Costing and Variance Analysis**20 lectures**

Budgeting and Budgetary Control: Concept of budget and budgetary control, objectives, merits and limitations, Budget administration, Functional budgets, Fixed and flexible budgets, Zero base budget, Programme and performance budgets.

Standard Costing and Variance Analysis: Meaning of standard cost and standard costing, Advantages, Limitations and applications, Variance Analysis: Material, Labor, Overhead and Sales variances, Disposition of variances, Control ratios.

Unit V: Absorption versus Variable Costing**13 lectures**

Distinctive features and income determination, Cost-Volume-Profit Analysis: Break-even analysis- algebraic and graphic methods, Contribution/Sales ratio, Key factor, Margin of Safety, Angle of incidence, Determination of cost indifference point, Decision Making- costs for decision making, variable costing and differential analysis as aids in making decisions- fixation of selling price, exploring new market, make or buy, product mix, operate or shut down, seller process further.

Suggested Readings:

- Horngreen, Charles T., George Foster and Srikant M. Dattar. Cost Accounting: A Managerial Emphasis. Prentice Hall of India Ltd., New Delhi.
- Horngreen, Charles T., Gary L. Sundem. Introduction to Management Accounting. Prentice Hall.

- Jain S.P. and K.L.Narang. Cost Accounting: Principles and Method. Kalyani Publishers, Jalandhar.
- Lal, Jawahar. Cost Accounting. Tata McGraw Hill Publishing Co., New Delhi.
- Nigam, B.M.Lall and I.C.Jain. Cost Accounting: Principles and Practice. Prentice Hall of India, New Delhi.
- Arora, M.N. Cost Accounting- Principles and Practice. Vikas Publishing House, New Delhi.
- Maheshwari, S.N. and S.N. Mittal. Cost Accounting: Theory and Problems. Shri Mahabir Book Depot, New Delhi.
- Singh, S.K. and Gupta Lovleen. Management Accounting-Theory and Practice. Pinnacle Publishing House.
- Usry, Milton E. and Lawrence H.Hammer. Cost Accounting: Planning and Control. South Western Publishing Co.
- Barfield, Jesset T., Cecily A. Raibarn and Michael R.Kinney. Cost Accounting: Traditions and Innovations. Thomas Learning.
- Lucey, T.Costing. ELST, London.
- Garrison H., Ray and Eric W,Noreen. Managerial Accounting. Mcgraw Hill.
- Drury, Colin. Management and Cost Accounting. Cengage Learning.
- Lal, Jawahar. Advanced Management Accounting Text and Cases. S.Chand & Co.m New Delhi.
- Khan, M.Y. and P.K.Jain. Management Accounting. Tata McGraw Hill publishing Co., New Delhi.
- Hansen, Managerial Accounting. Cengage Learning.

Semester V

Course code: COM 152
Course Title: Principles of Marketing

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective: The objective of this course is to provide basic knowledge of concepts, principles, tools and techniques of marketing.

CONTENTS

- Unit I: (a) Introduction** **6 lectures**
Nature, scope and importance of marketing; Evolution of marketing concepts; Marketing mix, Marketing environment.
- (b) Consumer Behavior- An Overview** **5 lectures**
Consumer buying process; Factors influencing consumer buying decisions.
- Unit II: (a) Market Selection** **6 lectures**
Market segmentation- concept, importance and bases; Target market selection; Positioning concept, Importance and bases; Product differentiation vs. Market segmentation.
- (b) Product** **9 lectures**
Meaning and importance; Product classifications; Concept of product mix; Branding, Packaging and labelling; Product-support; Product life-cycle; New product development.
- Unit III: (a) Pricing** **6 lectures**
Significance, Factors affecting price of a product, Pricing policies and strategies.
- (b) Promotion** **6 lectures**
Nature and importance of promotion; Communication process; Types of promotion- advertising, personal selling, public relations & sales promotion and their distinctive characteristics; Promotion mix and factors affecting promotion mix decisions.
- Unit IV: (a) Distribution** **7 lectures**
Channels of distribution- meaning and importance; Types of distribution channels; Wholesaling and Retailing; Factors affecting choice of distribution channel; Physical distribution.
- (b) Retailing** **6 lectures**
Types of retailing- store based and non-store based retailing, chain stores, specialty stores, supermarkets, retail vending machines, mail order houses, retail cooperatives; Management of retailing operations- an overview; Retailing in India- changing scenario.
- Unit V: (a) Rural Marketing** **7 lectures**
Growing importance; Distinguishing characteristics of rural markets; Understanding rural consumers and rural markets; Marketing mix planning for rural markets.
- (b) Recent developments in marketing** **7 lectures**
Social marketing; Inline marketing; Direct marketing; Services marketing; Green marketing.

Suggested Readings:

- Kotler, Philip, Gary Armstrong, Prafulla Agnihotri and Ashan UI Haque. Principles of Marketing. 13th edition. Pearson Education.
- Michael, J. Etzel, Bruce J. Walker, William J Staton and Ajay Pandit. Marketing Concepts and Cases. (Special Indian Edition).
- McCarthy, E. Jerome, and William D. Perreault. Basic Marketing. Richard D. Irwin.
- Lamb, Charles W., Joseph F. Hair, Dheeraj Sharma and Carl McDaniel. Marketing: A South Asian Perspective. Cengage Learning.
- Pride, William M., and D.C. Ferrell. Marketing Planning, Implementation & Control. Cengage Learning.
- Majaro, Simon. The Essence of Marketing. Prentice Hall, New Delhi.
- Zikmund William G. and Michael D. Amico. Marketing: Creating and Keeping Customers in an E-Commerce World. Thomson Learning.
- Chhabra, T.N., and S.K. Grover. Marketing Management. Fourth Edition. Dhanpat Rai &

Semester VI

Course code: COM 161
Course Title: Financial Management

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

To familiarize the students with the principles and practices of financial management.

CONTENTS**Unit I: Introduction****8 lectures**

Scope and objective; Time value of money; Risk and return (including Capital Asset Pricing Model); Valuation of securities- Bonds and Equities.

Unit II: Capital Budgeting Decision**20 lectures**

Process; Cash flow estimation; Payback Period Method; Accounting Rate of Return; Net Present value(NPV); Net Terminal Value; Internal Rate of Return(IRR), Profitability Index; Capital budgeting under Risk- Certainty Equivalent Approach and Risk- Adjusted Discount Rate.

Unit III: Cost of Capital and Financing Decision**20 lectures**

Sources of long-term financing estimation of components of cost of capital; Methods for calculating cost of equity capital; Cost of Retained Earnings; Cost of Debt and Cost of Preference Capital; Weighted Average cost of Capital(WACC) and Marginal cost of Capital; Capital structure- Theories of Capital Structure (Net Income, Net Operating Income, MM Hypothesis, Traditional Approach); Operating and financial leverage; Determinants of capital structure.

Unit IV: Dividend Decision**12 lectures**

Theories for relevance and irrelevance of dividend decision for corporate valuation; Cash and stock dividends; Dividend policies in practice.

Unit V: Working Capital Decision**15 lectures**

Concepts of working capital; The risk-return trade off; Sources of short-term finance; Working capital estimation; Cash management; Receivables management; Inventory management and Payables management.

Note: Spreadsheet is the recommended software for doing basic calculations in finance and hence can be used for giving students subject related assignments for their internal assessment purposes.

Suggested Readings:

- Horne, J.C.Van and Wackowich. Fundamentals of Financial Management. 9th edition. New Delhi Prentice Hall of India.
- Levy H. and M.Sarnat. Principles of Financial Management. Engelwood Cliffs, Prentice Hall.
- Johnson, R.W.Financial Mnagement. Boston Allyn and Bacon.
- Joy, O.M. Introduction to Financial Management. Homewood: Irwin.
- Khan and Jain. Financial Management text and problems. 2nd edition. Tata McGraw Hill, New Delhi.
- Pandey, I.M. Financial Management. Vikas Publishing.
- Chandra, P. Financial Management- Theory and Practice. Tata McGraw Hill.
- Rustagi, R.P. Fudamentals of Financial Management. Taxmann Publication Pvt. Ltd.
- Singh, J.K. Financial Management-text and problems. 2nd Edition. Dhanpat Rai and Co., Delhi.
- Singh, Surender and Kaur, Rajeev. Fundamentals of Financial Management. Book Bank Interna-

Semester VI

Course code: COM 162
Course Title: Auditing and Corporal Governance

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

To provide knowledge of auditing principles, procedures and techniques in accordance with current legal requirements and professional standards.

Contents**Unit I: Introduction****13 lectures.**

Meaning, objects, basic principles and techniques; Classification of Audit; Audit Planning; Internal Control- Internal check and Internal audit; Audit procedure- Vouching and verification of Assets and Liabilities.

Unit II: Audit of Limited Companies**13 lectures**

Company Auditor- Qualifications and disqualifications, Appointment, Rotation, Removal, Remuneration, Rights and Duties; Auditor's Report- Content and types; Liabilities of Statutory Auditors under the Companies Act 2013.

Unit III: Special areas of Audit**13 lectures**

Special features of Cost audit, Tax audit and Management audit; Recent trends in auditing- basic considerations of audit in EDP environment; Standard on Auditing (SA); Relevant case studies/problems.

Unit IV: Corporate Governance**13 lectures**

Conceptual framework of corporate governance; Corporate governance reforms; Major corporate scandals in India and abroad- common governance problems noticed in various corporate failures; Codes & Standards on corporate governance.

Unit V: Corporate Social Responsibility (CSR)**13 lectures**

Strategic planning and corporate social responsibility; Corporate philanthropy; Meaning of CSR, CSR and CR, CSR and Corporate sustainability; CSR and business ethics; CSR and corporate governance; Environmental aspect of CSR; CSR provision under the Companies Act 2013; CSR Committees.

Suggested Readings:

1. Gupta, Kamal and Ashok Arora. Fundamentals of Auditing. Tata McGraw Hill Publishing Co.Ltd., New Delhi.
2. Jha, Aruna. Auditing. Taxmann,
3. Tendon, B.N., S.Sundharsanam and S.Sundharabahu. a Handbook of Practical Auditing. S. Chand and Co.Ltd., New Delhi.
4. Ghatalia, S.V. Practical Auditing. Allied Publishers Private Ltd., New Delhi.
5. Singh, A.K. and Gupta Lovleen. Auditing Theory and Practice. Galgotia Publishing Company.
6. Alvin Arens and James Loebbecke. Auditing: an Integrated Approach.
7. Ravinder Kumar and Virender Sharma, Auditing Principles and Practice, PHI Learning Christine A Mallin, Corporate Governance (Indian Edition), Oxford University Press, New Delhi.
8. Bob Tricker, Corporate Governance-Principles, Policies and Practice (Indian Edition), Oxford University Press, New Delhi.
9. The Companies Act 2013 (Relevant Sections).
10. MC Kuchal. Corporate Laws. Shri Mahaveer Book Depot. (Relevant Sections).
11. Relevant Publications of ICAI on Auditing (CARO).

DISCIPLINE SPECIFIC ELECTIVE COURSE**Semester V**

Course code: COM 251
Course Title: Advertising

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

The objective of this course is to familiarize the students with the basic concepts, tools and techniques of advertising used in marketing.

Contents**Unit I: Introduction****10 lectures**

Meaning, nature and importance of advertising; types of advertising; advertising objectives; Audience selection; setting of advertising budget; Determinants and major methods.

Unit II: Media Decisions**15 lectures**

Major media types- merits and demerits: Factors influencing media choice; Media selection; Media scheduling; emerging media options.

Unit III: Message Development**15 lectures**

Advertising appeals; types of appeals; Advertising copy and elements, types of advertising copy.

Unit IV: Measuring Advertising Effectiveness**15 lectures**

Objectives, importance, methods of measuring Advertising Effectiveness ; Evaluating communication and sales effects; pre and post-testing techniques.

Unit V: Advertising Agency**10 lectures**

Roles, types and selection of advertising agency; Social, and ethical aspects: legal and regulatory aspects of advertising in India- ASCI,AAAI(Advertising Agencies Association of India); Information and broadcasting

Suggested Readings:

1. Dunn, S. Wats and Arnold M. Barban. Advertising: Its role in marketing.
2. Belch and Belch. Advertising. McGraw Hill Co.
3. Burnett, Wells and Moriatty. Advertising: Principles and Practice. 5th edition. Prentice Hall of India, New Delhi.
4. Batra, Myers and Aakers. Advertising Management. 5th edition. Prentice Hall of India, New Delhi.
5. Terence A. Shimp. Advertising and promotion: An IMC Approach. Centage Learning.
6. Sharma, Kavita. Advertising: Planning and Decision Making. Taxmann Publication Pvt. Ltd.
7. Jaishree Jethwaney and Shruti Jain. Advertising Management. Oxford University Press, 2012.
8. Chunawala and Sethia. Advertisement. Himalaya Publishing House.
9. Ruchi Gupta. Advertising. S. Chand & Co.
10. O'Guinn. Advertising and promotion: An integrated Brand Approach. Cengage Learning.

Semester V

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course code: COM 252

Course Title: Business Research Method and Project Work

Objective:

This course aims at providing the general understanding of business research and the methods of business research. The course will impart learning about how to collect, analyze, present and interpret data.

Contents**Section A: Business Research Methods (50 marks)****Unit I: Introduction****10 lectures**

Meaning of research; Scope of business research; Purpose of research- exploration, description, explanation; Unit of analysis-individual, organizations, groups and data series; Conception, Construct, Attributes, Variables and Hypotheses.

Unit II: Research Process**10 lectures**

An overview; Problem identification and definition; Selection of basic research methods-field study, laboratory study, survey method, observational method, existing data based research, longitudinal studies, panel studies.

Unit III: Measurement and Hypothesis Testing**19 lectures**

Measurement: Definition; Designing and writing items; Uni-dimensional and Multi-dimensional scales; Measurement scales-nominal, ordinal, interval, ratio; Ratings and Ranking scale, Thurstone, Likert and Semantic Differential scaling; paired comparison; Sampling- steps, types, sample size decision; Secondary data sources.

Hypothesis Testing: Tests concerning means and proportions; ANOVA, Chi-square test and other Non-parametric tests; Testing the assumptions of Classical Normal Linear Regression.

Section B-Project Report (50 marks)**Unit IV: Report Preparation****26 lectures**

Meaning, types and layout of research report; Steps in report writing; Citations; Bibliography and Annexure in report; JEL Classification.

Note:

1. There shall be a written examination of 50% marks on the basis of unit I to III.
2. The student will write a project report under the supervision of a faculty member assigned by the College/Institution based on field work. The project report carries 50% marks and will be evaluated by University appointed examiners.

Semester VI

Course code: COM 261
Course Title: International Business

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective: The objective of the course is to expose students to the concept, importance and dynamics of international business and India's involvement with global business operations. The course also discusses theoretical foundations of international business to the extent these are relevant to understand the mechanics of global business operations and development.

Contents**Unit I****5 lecturers**

1. Introduction to International Business: Globalization and its growing importance in world economy; impact of globalization; International business contrasted with domestic business-complexities of international business; Modes of entry into international business.

7 lectures

2. International Business Environment: National and foreign environments and their components-economic, cultural and political-legal environments; Global trading environment- recent trends in world trade in goods and services; Trends in India's foreign trade.

Unit II

1. Theories of International Trade: An overview; Commercial policy instruments-tariff and non-tariff measures; Balance of payment account and its components.

6 lectures

2. International Organizations and Arrangements: WTO-objectives, principles, organizational structure and functioning; An overview of other organizations-UNCTAD, World Bank and IMF; Commodity and other trading agreements.

7 lectures**Unit III**

1. Regional Economic Co-operation: Forms of regional groupings; Integration efforts among countries in Europe, North America and Asia.

6 lectures

2. International Financial Environment: International financial system and institutions; Foreign Exchange markets and risk management; Foreign investments-types and flows; Foreign investment in Indian perspective.

8 lectures**Unit IV**

1. Organizational structure for international business operations: Key issues involved in making international production, finance, marketing and human resource decisions; International business negotiations.

8 lectures

2. Developments and issues in international business: Outsourcing and its potentials for India; Strategic alliances, mergers and acquisitions; Role of IT in international business; International business and ecological considerations.

6 lectures**Unit V**

1. Foreign trade promotion measure and organizations in India; Special Economic Zones (SEZs) and 100% export oriented units (EOUs); Measures for promoting foreign investments into and from India; Indian joint ventures and acquisitions abroad.

5 lectures

2. Financing of foreign trade and payment terms

5 lectures

Suggested Readings:

1. Charles W.L. Hill and Arun Kumar Jain. International Business. Tata McGrwa Hill, New Delhi.
2. Johnson, Derbe and Colin Turner. International Business-Themes & Issues in the Modern Global Economy. London:Roulledge.
3. Cherunilam, Francis. International Business: Text and Cases. Prentice Hall of India Ltd.
4. Daniels John, D.Lee H.Radenbaugh and David P.Sullivan. international Business. Pearson Education.
5. Justin, Paul. International Business. Prentice Hall of India Ltd.
6. Michael R. Czinkota. et.al. international Business. Forthforth: The Dryden Press.
7. Benett, Roger. International Business. Pearson Education.
8. Sumati Verma. International Business. Pearson Education.
9. V Sharan. International Business. Pearson Education.
10. Peng and Srivastav. Global Business. Cencage Learning.

Semester VI

Course code: COM 262
Course Title: Business Statistics

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective: The objective of this course is to familiarize students with the basic statistical tools used to summarize and analyze quantitative information for decision making.

Expected learning outcomes: The student is expected to be equipped with the tools of processing and description of statistical data. In addition, the student would develop competence to use computer for statistical calculations especially for comparatively large-sized problems.

Contents

Unit I: Statistical Data and Descriptive Statistics 19 lectures

- 1.1 Nature and classification of data: Univariate, bivariate and multivariate data; Time-series and cross-sectional data, Sampling concept and methods.
- 1.2 Measures of Central Tendency
 - a. Mathematical averages including arithmetic mean, geometric mean and harmonic mean; Properties and applications.
 - b. Positional Averages: Mode and Median (and other partition values including quartiles, deciles and percentiles) including graphic determination.
- 1.3 Measure of Variation: Absolute and Relative
Range, quartile deviation, mean deviation, standard deviation and their coefficients; Properties of standard variation/variance.
- 1.4 Skewness: Meaning, measurement using Karl Pearson and Bowley's measures; Concept of Kurtosis.

Unit II: Probability and Probability Distribution 14 lectures

- 2.1 Theory of probability; Approaches to the calculation of probability.
- 2.2 Calculation of event probabilities; Addition and multiplication laws of probability (proof not required)
- 2.3 Conditional probability and Bayes, theorem (proof not required).
- 2.4 Expectation and variance of a random variable.
- 2.5 Probability distributions
 - a. Binomial distribution: Probability distribution function, constants, shape, fitting of binomial distribution.
 - b. Poisson distribution: Probability function (including Poisson approximation to binomial distribution), Constants, Fitting of Poisson distribution.
 - c. Normal distribution: Probability distribution function, Properties of normal curve, calculation of probabilities.

Unit III: Simple Correlation and Regression Analysis 12 lectures

- 3.1 Correlation Analysis: Meaning of correlation-simple, multiple and partial; Linear and non-linear, correlation and causation, Scatter diagram, Pearson's co-efficient of correlation; Calculation and properties (proofs not required); Correlation and probable error; Rank correlation.
- 3.2 Regression Analysis: Principle of least squares and regression lines, regression equations and estimation; Properties of regression coefficients; relationship between correlation and regression

Unit IV: Index Numbers**10 lectures**

- 4.1 Meaning and uses of index numbers; Construction of index Numbers; Fixed and chain base; Univariate and composite; Aggregative and average of relatives-simple and weighted.
- 4.2 Tests of adequacy of index numbers; Base shifting; Splicing and deflating; problems in the construction of index numbers.
- 4.3 Construction of consumer price indices; Important share price indices including BSE SENSEX and NSE NIFTY.

Unit V: Time Series Analysis**10 lectures**

1. Components of time series; Additive and multiplicative models.
2. Trend analysis; Fitting of trend line using principle of least squares-linear, second degree parabola and exponential; Conversion of annual linear trend equation to quarterly/monthly basis and vice-versa; Moving averages.
3. Seasonal variations-calculation of seasonal indices using simple averages, Ratio-to-trend and Ratio-to-moving averages methods; Uses of seasonal indices.

Note: *The students will be familiarized with software and the statistical and other functions contained therein related to formation of frequency distribution and calculation of averages, measures of variation, correlation and regression coefficients.*

Suggested Readings:

1. Levin, Richard, David S. Rubin, Rastogi and Siddiqui. Statistics for Management. 7th Edition. Pearson Education.
2. Berenson and Levine. Basic Business Statistics: Concepts and Applications. Pearson Education.
3. Siegel Andrew F. Practical Business Statistics. McGraw Hill.
4. Vohra N.D. Business Statistics. McGraw Hill.
5. Spiegel M.D. Theory and Problems of Statistics. Schaum's outlines series. McGraw Hill Publishing Co.
6. Gupta, S.P. and Archana Gupta. Statistical Mathematics. Sultan Chand and Sons, New Delhi.
7. Gupta S.C. Fundamentals of Statistics. Himalaya Publishing House.
8. Anderson Sweeney and William. Statistics for Students of Economics and Business. Cengage Learning.
9. Thukral J.K. Business Statistics.

GENERIC ELECTIVE COURSE**Semester I**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course code: COM 311**Course Title: Consumer Affairs and Customer Care**

Objective: This paper seeks to familiarize the students with of their rights as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights. It also provides an understanding of the procedure of redressal of consumer complaints, and the role of different agencies in establishing product and service standards. The student should be able to comprehend the business firms' interface with consumers and the consumer related regulatory and business environment.

Content**Unit I: Conceptual Framework****13 lectures**

Consumer and Markets: Concept of consumers; Nature of markets; Concept of price in Retail and Wholesale; Maximum Retail Price (MRP) and Local taxes; Fair price; Misleading advertisements and deceptive packaging.

Experiencing Dissatisfaction: Complaining behavior; Form of complaint to a business; Making a complaint heard by the business; Corporate Redress Systems; Conciliation and intermediation for out-of-court redress

Quality and Standardization: Role of National Standards-National Standards, Indian Standards Mark (ISI); Agmark; Voluntary and mandatory standards; Licensing and Surveillance; Consumer grievance redress under the BIS Act, 1986; Introduction to International Standards ISO 10000 Suite; International standards on handling of consumer complaints by organizations.

Unit II: The Consumer Protection Act, 1986**13 lectures**

Objectives and Basic concepts: Consumer, goods, service, defect in goods, deficiency in service, spurious goods and services, unfair trade practice, restrictive trade practice.

Organizational set-up under the Consumer Protection Act

Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels, Basic consumer rights.

Adjudicatory Bodies: Composition, powers and jurisdiction (pecuniary and territorial): District Forum, State Commission, National commission.

Unit III: The Consumers Protection Act, 1986: Grievance Redress Mechanism under the CPA

Who can file a complaint? Grounds of filing a complaint; Limitation period; procedure for filing and hearing of a complaint; Temporary injunction; Reliefs which can be provided; Appeal; Enforcement of order; Bar on frivolous and vexatious complaints; Offences and penalties.

Seven leading cases decided under Consumer Protection Act::

1. Medical negligence
2. Bankinf and Financial service
3. Housing and Real Estate
4. Electricity, Water and Telecom services
5. Education
6. Defective product
7. Unfair Trade Practice.

13 lectures

Unit IV: Consumer Protection in India**13 lectures**

Consumer Movement in India: Formation of consumer organization and their role in consumer protection including Advocacy and Campaigning for policy intervention; Evolution of consumer movement in India; Recent developments in consumer protection in India; National consumer helpline, Citizens charter, Product selling.

Unit V: Competition Law**13 lectures**

Competition Act 2002: Objective, purpose and salient features; Concept of agreements having adverse impact on competition; Abuse of dominant position; Regulation of combination; Criteria for determining “Appreciable Adverse Effect on Competition” and “Dominant Position”; Relevant Geographic Market factors; Relevant Product Market factors.

Suggested Readings:

1. Khanna, Sri Ram, Hanspal, Savita, Kapoor, Sheetal and Awasthi, H.K. Consumer Affairs (2007) Delhi University Publication.
2. Aggarwal, V.K.(2003), Consumer Protection: Law and Practice. 5th ed. Bharat Law House, Delhi or latest edition.
3. Girimaji, Pushpa (2002). Consumer Right for Everyone. Penguin Books.
4. Nader, Ralph (1973). The Consumer and Corporate Accountability. USA, Harcourt Brace Jovanovich, Inc.
5. How to survive as a consumer? CUTS, India www.cuts.org.
6. Deepa Sharma. Grievance Redress and Consumer Protection in India. Lambert Academic Publishers Germany 2012.
7. The Competition Act, 2002.
8. The Consumers Protection Act, 1986.
9. The Bureau of Indian Standards Act, 1986.
10. The Food Safety and Standards Act

Semester II

Course code: COM 321
Course Title: Fundamentals of Investments

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective: To familiarize the students with different investment alternatives, introduce them to the framework of their analysis and valuation and highlight the role of investor protection.

Contents**Unit I: The Investment Environment****10 lectures**

The investment decision process, Types of Investments- commodities, real estate and financial assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of taxes and inflation on return.

Unit II: Fixed Income Securities**15 lectures**

Bond features, Types of bonds, estimating bond yields, Bond valuation, Types of bond risks, Default risk and credit rating.

Unit III: Approaches to Equity Analysis**15 lectures**

Introduction to fundamental analysis, Technical analysis and efficient market hypothesis, Dividend capitalization models, Price earnings multiple approach to equity valuation.

Unit IV: Portfolio Analysis and Financial Derivatives**15 lectures**

1. Portfolio and diversification, portfolio risk and return
2. Mutual Funds
3. Introduction to financial derivatives, financial derivatives markets in India.

Unit V: Investor Protection**10 lectures**

Role of SEBI and stock exchanges in investor protection, Investor grievances and their redressal system, Insider trading, Investors' awareness and activism.

Suggested Readings:

1. Jones, C.P., Investment Analysis and Management, Wiley, 8th edition.
2. Prasanna, Chandra, Investment Analysis and Portfolio Management, Tata McGraw Hill.
3. Rustogi, R.P., Fundamentals of Investment, Sultan Chand & Sons, New Delhi.
4. Vohra, N.D. and B.R. Bagri, Futures and Options, McGraw Hill Publishing.
5. Mayo, An Introduction to Investment, Cengage Learning.

Semester III

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course code: COM 331

Course Title: Financial Markets Institution & Financial Services

Objective: To provide the student a basic knowledge of financial markets and institutions and to familiarize them with major financial services in India.

Contents

Unit I: An Introduction to Financial System and its Components

8 lectures

Financial markets and institutions; Financial intermediation; Flow of funds matrix; Financial system and economic development; An overview of Indian financial system.

Unit II: Financial Markets

17 lectures

Money market-functions, organization and instruments; Role of Central Bank in money market; Indian money market-an overview.

Capital markets-functions, organization and instruments; Indian debt market; Indian equity market-primary and secondary markets; Role of stock exchanges in India.

Unit III: Financial Institutions

20 lectures

Commercial Banking-introduction, its role in project finance and working capital finance; Development Financial Institutions (DFIs)-an overview and role in Indian economy; Life and non-life insurance companies in India; Mutual Funds-introduction and their role in capital market development; Non-banking financial companies (NBFCs).

Unit IV: Overview of Financial Services Industry

8 lectures

Merchant banking-pre and post issue management, underwriting; regulatory framework relating to merchant banking in India.

Unit V: Leasing and Hire Purchase

22 lectures

Leasing and hire purchase; Consumer and housing finance; Venture capital finance; Factoring services, bank guarantees and letter of credit; Credit rating; Financial counseling.

Suggested Readings:

1. Bhole, L.M. Financial Markets and Institutions. Tata McGraw Hill Publishing Co.
2. Khan, M.Y. Indian Financial System- Theory and Practice. Vikas Publishing House.
3. Dhanekar. Pricing of Securities. New Delhi. Bharat Publishing House.
4. Prasanna, Chandra. Financial Management: Theory and Practice. Tata McGraw Hill Publishing Co.Ltd., New Delhi.
5. Simha, S.L.N. Development Banking in India. Madras: Institute of Financial Management and Research.
6. Khan and Jain. Financial Services. 2nd ed.Tata McGraw Hill.
7. Singh J.K. Venture Capital Financing in India. Dhanpat Rai and Co., New Delhi.
8. Annual Reports of Major Financial Institutions in India.

Semester IV

Course code: COM 341
Course Code: Organizational Behavior

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective: The objective of the course is to develop a theoretical understanding among students about the structure and behavior of organization as it develops over time. The course will also make them capable of realizing the competitiveness for firms.

Contents**Unit I: Organizational Theories and Behavior** **15 lectures**

Classical, Neo-classical and Contemporary, authority, power, status, formal and informal structure; Flat and tall structures; Bureaucratization of organizations; Organizational behavior- concepts, determinants, challenges and opportunities of OB; Contributing disciplines of OB; Individual behavior- foundations, values, attitudes, personality and emotions; Theory X and Theory Y, Chris Argyris behavior patterns; Perceptual process.

Unit II: Group Decision Making & Communication **10 lectures**

Concept and nature of decision making process; Individual versus group decision making; Nominal group technique and Delphi technique; Models of communication; Communication effectiveness in organizations; Feedback; TA; Jo Hari Window.

Unit III: Motivation **10 lectures**

Need hierarchy; Maslow's Need Hierarchy; Two Factor theory; Contemporary theories of motivation (ERG, Cognitive evaluation, goal setting, equity); Expectancy model; behavior modification; Motivation and organizational effectiveness.

Unit IV: Leadership **15 lectures**

Power and conflict- concept and theories; Behavioral approach; Situational approach; Leadership effectiveness; Contemporary issues in leadership; Power and conflict-bases of power, power tactics; Sources of conflict; Conflict resolution strategies.

Unit V: Organizational Culture, Organizational Development and Stress Management

Concept and determinants of organizational culture; Organizational development-concept and intervention techniques; Individual and organizational factors to stress; Consequences of stress on individual and organization; Management of stress.

15 lecturers**Suggested Readings:**

1. Robbins, S.P., Essentials of Organizational Behavior. Pearson Education.
2. Luthans, Fred. Organizational Behavior. McGraw Hill.
3. Robbins, S.P. Organizational Theory: Structure Design and Application. Pearson Education.
4. Newstrom. Organizational Behavior. McGraw Hill.
5. Nelson, Quick and Preetam Khandewal. Organizational Behavior. Cengage Learning.
6. Griffin and Moorhead. Organizational Behavior. Cengage Learning.

ABILITY ENHANCEMENT COURSE
Semester II

Course Code: ENG 421
Course Title: Business Communication

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 0:50 | - | - |

Unit – I: Process of Communication
Types of Communication: Formal and Informal
Importance of Communication

Unit – II: Barriers to communication:
Physical Barriers
Mechanical Barriers
Semantic Barriers
Cultural Barriers

Unit – III: Business Correspondence:
Inviting quotations
Sending quotations
Complaints and Adjustment letters
Agenda and Minutes of Meeting
Job Application Letter and Resume

Unit – IV: Business report writing:
Types, Characteristics, Importance, Elements of structure,

Unit – V: Oral Presentation Skills:
Extempore Speech
Mock Interviews

Recommended Readings:

1. Lesikar, R.V. & Flatley, M.E.; *Basic Business Communication Skills for Empowering the Internet Generation*, Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. *Fluency in English - Part II*, Oxford University Press, 2006.
3. *Business English*, Pearson, 2008.
4. Bovee and Thill, *Business Communication Today*, Pearson Education.
5. Shirley Taylor, *Communication for Business*, Pearson Education.
6. Locker and Kaczmarek, *Business Communication: Building Critical Skills*, TMH.

SKILL ENHANCEMENT COURSE

Semester III

Course code: COM 531
Course Title: E-Commerce

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Objectives: A student should become familiar with mechanism for conducting business transactions through electronic means.

Contents

Unit 1: Introduction

10 lectures

Meaning, nature, concepts, advantages and reasons for transacting online categories of E-Commerce, supply chain management, Customer Relations Management. Planning online business
Nature and dynamics of the interest, pure online vs. Brick and click business; assessing requirement of an online business designing, developing and deploying the system, one to one enterprise.

Unit 2: Technology for online business: Mechanism of making payment through internet.**10 lectures**

Internet, IT Infrastructure, middleware contents: text and integrating E-business applications
Online- payment mechanism; electronic payment systems; payment gateways; visitors to website; tools for promoting websites; plastic money: Debit card, Credit card.

Unit 3: Applications in E-Commerce and security and legal aspects of E-Commerce.**10 lectures**

E-Commerce applications in manufacturing, wholesale and service sector. Threats in E-Commerce, Security of clients and service provider; Cyber Law- Information Technology Act 2000: an overview of major provisions.

SKILL ENHANCEMENT COURSE**Semester IV**

Course Code: COM 541
Course Title: Entrepreneurship

| Credit : 2 | L - 2 | P - 0 | T - 0 |
|----------------|-------|-------|-------|
| Marks (CIA:ES) | 20:30 | - | - |

Objectives: The purpose of the paper is to orient the learner toward entrepreneurship as a career option and creative thinking and behaviour for effectiveness at work and in life.

Contents

Unit 1**10 lectures**

Meaning, elements, determinants and importance of entrepreneurship and creative behaviour. Entrepreneurship and creative response to the society problems and at work. Dimensions of entrepreneurship. Entrepreneurship and micro, small and medium enterprises. concept of business groups and role of business houses and family business in India.

Unit 2**10 lectures**

Role of industries/ entrepreneur's associations and self help group. The concept, role and functions of business incubators, angel investors, venture capital and private equity.

Unit 3**10 lectures**

Mobilizing resources for start-ups. Accommodation and utilities. Preliminary contracts with the vendors, suppliers, bankers, principal customers; contract management: basic start-up project.

Note:

Writing the business plan/project proposal; contents and designing business processes, location, layout, planning and control. Preparation of project report. project submission/ presentation and appraisal thereof by external agencies such as financial/non-financial institutions.

Suggested Readings:

1. S.S. Khanka, Entrepreneurship Development, S.Chand & Company.
2. Desai, Vasant. Dynamics of Entrepreneurship Development and Management, Mumbai, Himalaya Publishing House
1. Holt, David H. Entrepreneurship: New venture Creation. Prentice Hall of India, New Delhi.
2. Jain, Arun Kumar. Competitive Excellence: Critical Success Factors. New Delhi: Viva Books Limited
1. Kuratko and Rao, Entrepreneurship: A south Asian Perspective, Cengage Learning.

SCIENCE

BOTANY HONOURS

| Semester | Core course (14) <i>Credit (4+2) Each</i> | Ability Enhancement Compulsory Course(AEC) (2) <i>Credit 2 Each</i> | Skill Enhancement Course (SEC) (2) <i>Credit 2 Each</i> | Discipline Spe- cific Elective (DSE) (4) Credit (4+2) Each | Generic Elective (GE) (4) Credit (4+2) Each |
|---|--|--|---|---|---|
| I | Microbiology and Phycology | English Communication | | | GE-1 (Biomolecules and Cell biology) |
| | Biomolecules and Cell biology | | | | |
| II | Mycology and Phytopathology | Environmental Studies | | | GE-2 (Archegoniate) |
| | Archegoniate | | | | |
| III | Anatomy of Angiosperms | | SEC-1 (Floriculture) | | GE-3 (Anatomy of Angiosperms) |
| | Economic Botany | | | | |
| | Basics of Genetics | | | | |
| IV | Molecular Biology | | SEC-2 (Mushroom Cul- ture Technology) | | GE-4 (Plant Systematics) |
| | Ecology | | | | |
| | Plant Systematics | | | | |
| V | Reproductive Biology of Angiosperms | | | DSE-1 (Plant Breeding) | |
| | Plant Physiology | | | DSE-2 (Natural Resource Management) | |
| VI | Plant Metabolism | | | DSE-3 (Industrial and Environmental Microbiology) | |
| | Plant Biotechnology | | | DSE-4 (Biostatistics) | |
| No. of Courses (Credits) | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |

CORE COURSES**Semester-I**

Course Code: BOT 111
Course Title: Microbiology and Phycology

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit I: Introduction to microbial world (12 lectures)

Microbial nutrition, growth and metabolism. Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine). Role of algae in the agriculture and industry.

Unit II: Viruses (12 lectures)

Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV), Retro virus (HIV)

Unit III: Bacteria (12 lectures)

General characteristics; Types-archaeobacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction).

Unit IV: Algae I (12 lectures)

General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; methods of reproduction; Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only upto groups);

Unit V: Algae II (12 lectures)

General characters, ecology and occurrence, range of thallus organization, cell structure and reproduction in Cynophyta (*Nostoc*), Chlorophyta (*Chara*), Xanthophyta (*Vaucheria*), Phaeophyta (*Ectocarpus*) and Rhodophyta (*Polysiphonia*)

Practical

Course Code: BOT(L) 111

Course Title: Microbiology

1. Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle.
2. Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule.
3. Gram staining.
4. Endospore staining with malachite green using the (endospores taken from soil bacteria).

Phycology

Study of vegetative and reproductive structures of *Nostoc*, *Chlamydomonas*, *Volvox*, *Oedogonium*, *Spirogyra*, *Chara*, *Ectocarpus* and *Polysiphonia*,

Suggested Readings

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
5. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
6. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.

Semester-I

Course Code: BOT 112
Course Title: Biomolecules and Cell Biology

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60**Unit I: Biomolecules (20 lectures)**

Introduction: Types and significance of chemical bonds; Structure and properties of water; pH and buffers.

Carbohydrates: Nomenclature and classification; Role of monosaccharides (glucose, fructose); Disaccharides (sucrose, maltose, lactose), Oligosaccharides and polysaccharides (structural-cellulose, hemicelluloses, pectin, storage – starch, inulin); Isomers and derivatives of glucose.

Lipids: Definition and major classes of storage and structural lipids. Fatty acids structure and functions. Saponification. Structural lipids. Phosphoglycerides: Building blocks, General structure, functions and properties. Structure of phosphatidylethanolamine and phosphatidylcholine, Sphingolipids: building blocks, structure of sphingosine, ceramide.

Proteins: Structure of amino acids; Peptide bonds; Levels of protein structure-primary, secondary, tertiary and quaternary; Isoelectric point; Protein denaturation and biological roles of proteins.

Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA.

Unit II: Bioenergetics and Enzymes (4+6=10 lectures)

Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as a energy currency molecule.

Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity.

Unit III: The cell and its membrane systems (8 lectures)

Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).

Chemistry, structure and function of Plant Cell Wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.

Unit IV: Cell organelles (16 lectures)

Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus.

Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament.

Chloroplast, mitochondria and peroxisomes: Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast.

Endomembrane system: Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing and quality control in ER, smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – Organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes.

Unit V: Cell division (6 lectures)

Eukaryotic cell cycle, mitosis and meiosis. Regulation of cell cycle.

PRACTICAL

Course Code: BOT(L) 112

Course Title: Lab: Biomolecules and Cell Biology

Biomolecules:

1. Estimation of Glucose by Anthrone method.
2. Estimation of Cholesterol by Liebermann-Burchard reaction method.
3. Estimation of protein concentration Lowry's method.
4. Separation of amino acids by paper chromatography method.

Cell biology:

5. Study of plant cell structure with the help of epidermal peel of Onion/*Rhoeo*/*Crinum*.
6. Measurement of cell size by the technique of micrometry.
7. Counting the cells per unit volume with the help of haemocytometer. (Yeast/pollen grains).
8. Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique.
9. Study different stages of mitosis and meiosis.

Suggested Readings

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H.Freeman and Company.
6. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
7. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
8. Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
9. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco

Semester-II

Course Code: BOT 121
 Course Title: Mycology and Phytopathology

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60**Unit 1: Introduction to true fungi and Ascomycota (12 lectures)**

True fungi; General characteristics; Ecology; Thallus organization, Chytridiomycota (*Synchytrium*) and Zygomycota (*Rhizopus*)

Ascomycota; General characteristics (asexual and sexual fruiting bodies); Ecology; Life cycle, Heterokaryosis and parasexuality; Life cycle and classification with reference to *Saccharomyces*, *Penicillium* and *Alternaria*.

Unit II: Basidiomycota (12 lectures)

General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat *Puccinia* (Physiological Specialization), *Agaricus*; Bioluminescence, Fairy Rings and Mushroom Cultivation. Symbiotic association; Lichens and Mycorrhiza.

Unit III: Oomycota and Allied Fungi (12 lectures)

Oomycota; General characteristics; Ecology; Life cycle and classification with reference to *Phytophthora*, *Albugo*.

Allied Fungi; General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies.

Unit IV: Applied Mycology (12 Lectures)

Role of fungi in biotechnology; Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology.

Unit V: Phytopathology (12 lectures)

Terms and concepts; General symptoms; Geographical distribution of diseases; Etiology; Symptomology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine.

Bacterial diseases – Citrus canker and angular leaf spot of cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing. Fungal diseases – Early blight of potato, White rust of crucifers.

PRACTICAL

Course Code: BOT(L) 121

Course Title: Lab: Mycology and Phytopathology

1. Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, ascocarps & basidiocarps).
2. *Rhizopus*: study of asexual stage from temporary mounts and sexual structures through permanent slides.
3. *Aspergillus* and *Penicillium*: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs.
4. *Peziza*: sectioning through ascocarp.
5. *Alternaria*: Specimens/photographs and temporary mounts.
6. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts.
7. *Agaricus*: Specimens of button stage and full grown mushroom; sectioning of gills of *Agaricus*, fairy rings and bioluminescent mushrooms to be shown.
8. Study of phaneroplasmodium from actual specimens and /or photograph. Study of *Stemonitis* sporangia.
9. *Albugo*: Study of symptoms of plants infected with *Albugo*; asexual phase study through section/ temporary mounts and sexual structures through permanent slides.
10. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs)
11. Phytopathology: Herbarium specimens of bacterial diseases; Citrus Canker; bacteria wilt of tomato, Viral diseases: TMV, Vein clearing, Fungal diseases: Early blight of potato and White rust of crucifers. Blast of rust

Suggested Readings

1. Agrios, G.N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
3. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
4. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
5. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.

Course Code: BOT 122
Course Title: Archegoniate

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit I: Introduction (12 lectures)

Unifying features of archegoniate; Transition to land habit; Alternation of generations.

Bryophytes general characteristics; Adaptations to land habit; Classification; Range of thallus organization. Pteridophytes general characteristics; Classification; Early land plants (*Cooksonia* and *Rhynia*).

Unit II: Type Studies- Bryophytes (12 lectures)

Classification (up to family), morphology, anatomy, reproduction and evolutionary trends of *Marchantia*, *Anthoceros*, *Sphagnum* and *Funaria*; Ecological and economic importance of bryophytes with special reference to *Sphagnum*.

Unit III: Type Studies- Pteridophytes (12 lectures)

Classification (up to family), morphology, anatomy and reproduction of *Psilotum*, *Selaginella*, *Equisetum* and *Pteris* (Developmental details not to be included). Apogamy, and apospory, heterospory and seed habit, telome theory, stelar evolution; Ecological and economic importance.

Unit IV: Gymnosperms (12 lectures)

General characteristics, classification (up to family), morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum* (Developmental details not to be included); Ecological and economic importance.

UNIT V Paleobotany (12 lectures)

Geological time scale, fossil types and their formation, general account of dominant fossil flora of different ages, paleobotany in relation to exploration to taxonomy

PRACTICAL**Course Code:** BOT(L) 122**Course Title:** Lab: Archegoniate

Marchantia- Morphology of thallus, vertical section of thallus, whole mount of Gemmae (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides).

Anthoceros- Morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide).

Funaria- Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema.

Selaginella- Morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobilus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide).

Equisetum- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide).

Pteris- Morphology, transverse section of rachis, vertical section of sporophyll, whole mount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide).

Cycas- Morphology (coralloid roots, bulbil, leaf), whole mount of microsporophyll, transverse section of coralloid root, transverse section of rachis, vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide).

Pinus- Morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle, transverse section of stem, longitudinal section of / transverse section of male cone, whole mount of microsporophyll, whole mount of Microspores (temporary slides), longitudinal section of female cone, tangential longitudinal section & radial longitudinal sections stem (permanent slide).

Gnetum- Morphology (stem, male & female cones), transverse section of stem, vertical section of ovule (permanent slide)

Sphagnum- Morphology of plant, whole mount of leaf (permanent slide only).

Psilotum- Study of specimen, transverse section of synangium (permanent slide).

Suggested Readings

1. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
2. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
4. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
5. Vanderpoorten, A. & Goffinet, B. (2009) Introduction to Bryophytes. Cambridge University Press.

Semester-III

Course Code: BOT 131
Course Title: Anatomy of Angiosperms

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit I: Introduction and scope of Plant Anatomy (4 Lectures)

Applications in systematics, forensics and pharmacognosy.

Unit II: Structure and Development of Plant Body (18 Lectures)

Internal organization of plant body: Tissue systems, types of cells and tissues.

Development of plant body: Cytodifferentiation.

Classification of tissues; Simple and complex tissues (no phylogeny); cytodifferentiation of tracheary elements and sieve elements; Pits and plasmodesmata; adcrustation and incrustation, Ergastic substances. Hydathodes, cavities, lithocysts and laticifers.

Unit III: Apical meristems (15 Lectures)

Evolution of concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Cor-
pus theory, cytohistological zonation); Types of vascular bundles; Structure of dicot and monocot
stem. Origin, development, Structure of dicot and monocot leaf, Kranz anatomy. Organization of
root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap;
Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root.

Unit IV: Vascular Cambium and Wood (15 Lectures)

Structure, function and seasonal activity of cambium; Secondary growth in root and stem.

Axially and radially oriented elements; Types of rays and axial parenchyma; Sapwood and heartwood;
Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology. Development and
composition of periderm, rhytidome and lenticels.

Unit V: Adaptive and Protective Systems (8 Lectures)

Epidermal tissue system, cuticle, epicuticular waxes, trichoes (uni-and multicellular, glandular and non
glandular, two examples of each), stomata (classification); Adcrustation and incrustation; Anatomical
adaptations of xerophytes and hydrophytes.

PRACTICAL**Course Code:** BOT(L) 131**Course Title:** Lab: Anatomy of Angiosperms

1. Study of anatomical details through permanent slides/temporary stain mounts/ macerations museum specimens with the help of suitable examples.
2. Apical meristem of root, shoot and vascular cambium.
3. Distribution and types of parenchyma, collenchyma and sclerenchyma.
4. Xylem: Tracheary elements-tracheids, vessel elements; thickenings; perforation plates; xylem fibres.
5. Wood: ring porous; diffuse porous; tyloses; heart- and sapwood.
6. Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres.
7. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular.
8. Root: monocot, dicot, secondary growth.
9. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels.
10. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy).
11. Adaptive Anatomy: xerophytes, hydrophytes.
12. Secretory tissues: cavities, lithocysts and laticifers.

Suggested Readings

1. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
3. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
4. Evert, R.F. (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc.

Course Code: BOT 132
Course Title: Economic Botany
THEORY: Lectures: 60

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Unit I: Origin of Cultivated Plants (6 lectures)

Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions; Crop domestication and loss of genetic diversity; importance of germplasm diversity.

Unit II: Cereals, Legumes, Sugars and Starches (12 lectures)

Cereals; Maize and Rice (origin, morphology, processing & uses);
 Legumes; General account, soya bean, rice bean, Importance to man and ecosystem
 Sugars; Morphology and processing of sugarcane, products and by-products of sugarcane industry.
 Starches; Potato – morphology, propagation & uses.

Unit III: Spices, Beverages and oils and fats (12 lectures)

Spices; Listing of important spices, their family and part used. Economic importance with special reference to fennel, saffron, clove and black pepper
 Beverages; Tea, Coffee (morphology, processing & uses)
 Oils and fats; General description, classification, extraction, their uses and health implications; groundnut, soybean, mustard and coconut (Botanical name, family & uses).

Unit IV: Essential Oils: Natural Rubber Drug-yielding plants (12 lectures)

Essential Oils: General account, extraction methods, comparison with fatty oils & their uses.
 Natural Rubber; Para-rubber: tapping, processing and uses.
 Drug-yielding plants; Therapeutic and habit-forming drugs with special reference to *Cinchona*, *Papaver*, *Panax*, *Taxus* and *Cannabis*; Tobacco (Morphology, processing, uses and health hazards).

Unit V: Bamboo and cane, Timber plants Fibers (12 Lectures)

Bamboo and cane; morphology and utilization pattern.
 Timber; General account with special reference to Teak, Pinus and indigenous trees.
 Fibers; Classification based on the origin of fibers; Cotton and Jute (morphology, extraction and uses).

PRACTICAL**Course Code: BOT(L) 132****Course Title: Lab: Economic Botany**

1. **Cereals:** Wheat (habit sketch, L. S/T.S. grain, starch grains, micro-chemical tests) Rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests).
2. **Sources of sugars and starches:** Sugarcane (habit sketch; cane juice- micro-chemical tests), Potato(habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, w.m. starch grains, micro-chemical tests).
3. **Spices:** Black pepper, Fennel and Clove (habit and sections).
4. **Beverages:** Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).
5. **Sources of oils and fats:** Coconut- T.S. nut, Mustard–plant specimen, seeds; tests for fats in crushed seeds.
6. **Essential oil-yielding plants:** Habit sketch of *Rosa*, *Vetiveria*, *Santalum* and *Eucalyptus* (specimens/photographs).
7. **Rubber:** specimen, photograph/model of tapping, samples of rubber products.
8. **Drug-yielding plants:** Specimens of *Digitalis*, *Papaver* and *Cannabis*.
9. **Tobacco:** specimen and products of Tobacco.
10. **Woods:** *Tectona*, *Pinus*: Specimen, Section of young stem.
11. **Fiber-yielding plants:** Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fiber).

Suggested Readings

1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
3. Chrispeels, M.J. and Sadava, D.E. 1994 Plants, Genes and Agriculture. Jones & Bartlett Publishers.

Course Code: BOT 133
Course Title: Basics of Genetics

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit I: Structure of gene & Mendelian genetics and its extension (16 lectures)

Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; Structure of Phage T₄,

Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Penetrance and Expressivity, Polygenic inheritance.

Unit II: Extrachromosomal Inheritance (10 lectures)

Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast; Maternal effects-shell coiling in snail; Infective heredity- Kappa particles in *Paramecium*.

Unit III: Linkage, crossing over and chromosome mapping (10 lectures)

Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping; Sex Linkage.

Unit IV: Variation in chromosome number and structure & Gene mutations (14 lectures)

Deletion, Duplication, Inversion, Translocation, Euploidy and Aneuploidy

Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations

Unit V: Population and Evolutionary Genetics (10 lectures)

Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.

Practical

Course Code: BOT(L) 133

Course Title: Lab: Basics of Genetics

1. Meiosis through temporary squash preparation.
2. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
3. Chromosome mapping using point test cross data.
4. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
5. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
6. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.
7. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
8. Study of human genetic traits: Colour blindness, Widow's peak, Rolling of tongue, Hitchhiker's thumb and Attached ear lobe.

Suggested Readings

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings, U.S.A. 9th edition.
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

Semester-IV

Course Code: BOT 141
Course Title: Molecular Biology

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Unit 1**Nucleic acids: DNA and RNA (12 Lectures)**

Nucleic Acid, Historical perspective: DNA as the carrier of genetic information

DNA structure: Salient features of double helix, Types of DNA, denaturation and renaturation, cot curves; Organization of DNA- Prokaryotes, Viruses, Eukaryotes; DNA of mitochondria and chloroplast; RNA Structure; The Nucleosome, Chromatin structure: Euchromatin and Heterochromatin- Constitutive and Facultative heterochromatin.

Unit II**The replication of DNA (10 lectures)**

Chemistry of DNA synthesis (Kornberg's discovery); General principles – bidirectional, Semi-conservative and semi-discontinuous replication; RNA priming; Various models of DNA replication, including rolling circle, θ (theta) mode of replication, replication of linear ds-DNA, replication of the 5' end of linear chromosome; Enzymes involved in DNA replication.

Unit III**Central dogma and genetic code (16 lectures)**

Concept of Central dogma; Genetic code (deciphering & salient features)

Transcription

Transcription in prokaryotes and eukaryotes; Principles of transcriptional regulation;

Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in *E.coli*. Eukaryotes transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing.

Unit IV**Processing and modification of RNA (10 lectures)**

Split genes-concept of introns and exons, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing eukaryotic mRNA processing (5' cap, 3' polyA tail); Ribozymes; RNA editing and mRNA transport.

Unit V**Translation (12 lectures)**

Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases;

Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins.

PRACTICAL**Course Code: BOT(L) 141****Course Title: Lab: Molecular Biology**

1. Preparation of LB medium and raising *E.Coli*.
2. Isolation of genomic DNA from *E.Coli*.
3. DNA isolation from plants
4. DNA estimation by diphenylamine reagent/UV Spectrophotometry.
5. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).
6. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.
7. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments)
8. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.

Suggested Readings

1. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
4. Russell, P. J. (2010). i-Genetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
5. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

Course Code: BOT 142
Course Title: Ecology

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit 1: Ecology and ecological factors (22 lectures)

Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis.

Soil: Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development.

Water: Importance: States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil; Water table.

Light, temperature, wind and fire: Variations; adaptations of plants to their variation.

Unit II: Biotic interactions (2 lectures)

Relationships among organisms- positive and negative interactions.

Unit III: Population and Plant communities ecology (12 lectures)

Basic concepts, Characteristics and Dynamics. Ecological Speciation

Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts.

Unit IV: Ecosystems and their functional aspects (12 lectures)

Structure; Processes; Trophic organisation; Food chains and Food webs; Ecological pyramids.

Principles and models of energy flow; Production and productivity; Ecological efficiencies;

Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.

Unit V: Phytogeography (12 lectures)

Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local Vegetation.

PRACTICAL

Course Code: BOT(L) 142

Course Title: Lab: Ecology

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH of various soil and water samples (pH meter, universal indicator/Lovibond comparator and pH paper)
3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests.
4. Determination of organic matter of different soil samples by Walkley & Black rapid titration method.
5. Comparison of bulk density, porosity and rate of infiltration of water in soils of three habitats.
6. Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
7. (a). Study of morphological adaptations of hydrophytes and xerophytes (four each). (b). Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobancha*) Epiphytes, Predation (Insectivorous plants).
8. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).
9. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
10. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus.
11. Field visit to familiarise students with ecology of different sites.

Suggested Readings

1. Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
2. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
4. Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
5. Kormondy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.

Course Code: BOT 143
Course Title: Plant Systematics

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit 1: Plant Systematics (12 lectures)

Introduction to systematics; Plant identification, Classification, Nomenclature. Biosystematics. Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access.

Unit II: Concept and Botanical nomenclature (12 lectures)

Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary).

Botanical nomenclature; Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.

Unit III: Systems of classification (12 lectures)

Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series)

Unit IV: Modern taxonomy (12 lectures)

Biometrics, numerical taxonomy and cladistics

Taxonomy in relation to palynology, cytology, phytochemistry and molecular data

Unit V: Phylogeny of Angiosperms (12 lectures)

Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).

Practical

Course Code: BOT(L) 143

Course Title: Lab: Plant Systematics

1. Study of vegetative and floral characters of 10 common locally available
2. Field visit (local)
3. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Suggested Readings

1. Singh, (2012). *Plant Systematics: Theory and Practice* Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
2. Jeffrey, C. (1982). *An Introduction to Plant Taxonomy*. Cambridge University Press, Cambridge.
3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). *Plant Systematics-A Phylogenetic Approach*. Sinauer Associates Inc., U.S.A. 2nd edition.
4. Maheshwari, J.K. (1963). *Flora of Delhi*. CSIR, New Delhi.
5. Radford, A.E. (1986). *Fundamentals of Plant Systematics*. Harper and Row, New York.

Semester-V

Course Code: BOT 151
 Course Title: Reproductive Biology of Angiosperms

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit I: Introduction & Reproductive development (10 lectures)

History (contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison) and scope.

Induction of flowering; flower as a modified determinate shoot. Flower development: genetic and molecular aspects.

Unit II: Anther and pollen biology (10 lectures)

Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance.

Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure, NPC system;

Palynology and scope (a brief account); Pollen wall proteins; Pollen viability, storage and germination;

Abnormal features: Pseudomonads, polyads, massulae, pollinia.

Unit III: Ovule (10 lectures)

Structure; Types; Special structures—endothelium, obturator, aril, caruncle and hypostase; Female gametophyte— megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of *Polygonum* type); Organization and ultrastructure of mature embryo sac.

Unit IV: Pollination and fertilization & Embryo, Endosperm and Seed (15 lectures)

Pollination types and significance; adaptations; structure of stigma and style; path of pollen tube in pistil; double fertilization.

Structure and types; General pattern of development of dicot and monocot embryo and endosperm;

Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition of embryo; Unusual features; Embryo development in *Paeonia*. Seed structure, importance and dispersal mechanisms

Unit V: Self incompatibility & Polyembryony and apomixis (15 lectures)

Basic concepts (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSI); Methods to overcome self- incompatibility: mixed pollination, bud pollination, stub pollination; Intra-ovarian and *in vitro* pollination; Modification of stigma surface, parasexual hybridization; Cybrids, *in vitro* fertilization.

Polyembryony and apomixes; Introduction; Classification; Causes and applications

PRACTICAL

Course Code: BOT(L) 151

Course Title: Lab: Reproductive Biology of Angiosperms

1. Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation.
3. Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, psuedomonads, polyads, pollinia (slides/photographs, fresh material), ultrastructure of pollen wall (micrograph); Pollen viability: Tetrazolium test, germination: Calculation of percentage germination in different media using hanging drop method.
4. Ovule: Types-anatropous, orthotropous, amphitropous/campylotropous, circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs).
5. Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus.
6. Intra-ovarian pollination; Test tube pollination through photographs.
7. Endosperm: Dissections of developing seeds for endosperm with free-nuclear haustoria.
8. Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages; Study of suspensor through electron micrographs.

Suggested Readings

1. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
2. Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
3. Raghavan, V. (2000). Developmental Biology of Flowering plants, Springer, Netherlands.
4. Johri, B.M. I (1984). Embryology of Angiosperms, Springer-Verlag, Netherlands.

Course Code: BOT 152
Course Title: Plant Physiology
THEORY: Lectures: 60

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Unit I: Plant water relationship (10 lectures)

Water Potential and its components, water absorption by roots, aqua-porins, pathway of water movement, guttation. Ascent of sap—cohesion-tension theory. Transpiration and factors affecting transpiration, anti transpirants, mechanism of stomatal movement.

Unit II: Mineral nutrition (8 lectures)

Essential and beneficial elements, macro and micronutrients, methods of study and use of nutrient solutions, mineral deficiency symptoms, roles of essential elements, chelating agents.

Unit III: Nutrient Uptake and Translocation in the phloem (16 lectures)

Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport.

Experimental evidence in support of phloem as the site of sugar translocation. Pressure–Flow Model; Phloem loading and unloading; Source–sink relationship.

Unit IV: Plant growth regulators (14 lectures)

Discovery, chemical nature (basic structure), physiological roles of Auxin, Gibberellins, Cytokinin, Abscisic acid and Ethylene.

Unit V: Physiology of flowering, Phytochrome (12 lectures)

Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy.

Discovery, chemical nature, role of phytochrome in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action.

PRACTICAL

Course Code: BOT(L) 152

Course Title: Lab: Plant Physiology

1. Determination of transpiration rates from two surfaces of Dicotyledonous leaf by Bell jar method.
2. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte leaves.
3. To study the phenomenon of seed germination (effect of light).
4. To study the induction of amylase activity in germinating grains.

Demonstration experiments

1. To demonstrate suction due to transpiration.
2. Fruit ripening/Rooting from cuttings (Demonstration).
3. Bolting experiment/*Avena* coleoptile bioassay (demonstration).

Suggested Readings

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
2. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
3. Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.

Semester-VI

Course Code: BOT 161
Course Title: Plant Metabolism

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit I: Concept of metabolism and Carbon assimilation (20 lectures)

Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and Isozymes).

Photosynthetic pigments (chlorophylls and accessory pigments) and their roles, antenna molecules and reaction centres, photochemical reactions, photosynthetic electron transport, PSI, PSII, C₃, C₄ and CAM pathways, CO₂ reduction, photorespiration; Factors affecting CO₂ reduction.

Unit II: Carbohydrate metabolism and Carbon Oxidation (12 lectures)

Synthesis and catabolism of sucrose and starch.

Glycolysis, fate of pyruvate, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle, mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, factors affecting respiration.

Unit III: ATP-Synthesis (8 lectures)

Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic mechanism (oxidative and photophosphorylation).

Unit IV: Lipid metabolism (8 lectures)

Synthesis and breakdown of triglycerides, β -oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α oxidation.

Unit V: Nitrogen metabolism (12 lectures)

Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; Ammonia assimilation and transamination.

Mechanisms of signal transduction

Calcium, phospholipids, cGMP, NO.

PRACTICAL

Course Code: BOT (L) 161
Course Title: Lab: Plant Metabolism

1. Separation of photosynthetic pigments by chemical method.
2. To study the effect of light intensity on the rate of photosynthesis.
3. Effect of carbon dioxide on the rate of photosynthesis.
4. Determination of RQ of different Respiratory substrates.
5. To study the activity of lipases in germinating oilseeds and demonstrate mobilization of lipids during germination.

Suggested Readings

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
2. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
3. Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.

Course Code: BOT 162
Course Title: Plant Biotechnology

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY Lectures: 60

Unit I: Plant Tissue Culture (16 lectures)

Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic).

Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation).

Unit II: Recombinant DNA technology (12 lectures)

Restriction Endonucleases (History, Types, biological role and application); Restriction

Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).

Unit III: Gene Cloning (10 lectures)

Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR mediated gene cloning; Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; PCR

Unit IV: Methods of gene transfer (10 lectures)

Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics— selectable marker and reporter genes.

Unit V: Applications of Biotechnology (12 lectures)

Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products—Human Growth Hormone; Humulin; Biosafety concerns.

Practical

Course Code: BOT(L) 162

Course Title: Lab: Plant Biotechnology

1. (a) Preparation of MS medium.

(b) Demonstration of *in vitro* sterilization and inoculation methods using leaf and nodal explants of tobacco, *Datura*, *Brassica* etc.

2. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.

3. Isolation of protoplasts.

4. Construction of restriction map of circular and linear DNA from the data provided.

5. Study of methods of gene transfer through photographs: *Agrobacterium*-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.

6. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.

7. Isolation of plasmid DNA.

8. Restriction digestion and gel electrophoresis of plasmid DNA.

Suggested Readings

1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.

2. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

3. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.

4. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.

5. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

DISCIPLINE SPECIFIC ELECTIVE COURSES

Course Code: BOT 251
Course Title: Plant Breeding

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Unit I: Plant Breeding (10 lectures)

Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding.

Unit II: Methods of crop improvement (20 lectures)

Introduction: Centres of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations.

Unit III: Quantitative inheritance (10 lectures)

Concept, mechanism, examples of inheritance of Kernel colour in wheat. Monogenic vs polygenic Inheritance.

Unit IV: Inbreeding depression and heterosis (10 lectures)

History, genetic basis of inbreeding depression and heterosis; Applications.

Unit V: Crop improvement and breeding (10 lectures)

Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.

Suggested Readings

1. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
2. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.

PRACTICAL

Course Code: BOT(L) 251
Course Title: Lab: Plant Breeding

Emasculation, bagging, tagging and pollination techniques in self-& cross-pollinated crops.

Study of genotypic, phenotypic ratios and Hardy-Weinberg equilibrium of Mendelian population of locally available crops.

Study of the techniques of hybrid seed production and its applications.

Study of polyploidy breeding and its role in crop improvement.

Suggested Readings

1. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
2. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.
3. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.

Course Code: BOT 252
Course Title: Natural Resource Management

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit I: Natural resources and Sustainable utilization (12 lectures)

Definition and types. Concept, approaches (economic, ecological and socio-cultural).

Unit II: Land and Water (12 lectures)

Utilization (agricultural, horticultural, silvicultural); Soil degradation and management. Fresh water (rivers, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.

Unit III: Biological Resources (12 lectures)

Biodiversity-definition and types; Significance; Threats; Management and conservation strategies; Bioprospecting; IPR; CBD; National Biodiversity Action Plan).

Unit IV: Forests and Energy (12 lectures)

Definition, Cover and its significance (with special reference to Nagaland); Major and minor Forest products; Depletion; Management. Renewable and non-renewable sources of energy

Unit V: Contemporary practices in resource management (12 lectures)

EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management.

Practical

Course Code: BOT(L) 252

Course Title: Lab: Natural Resource Management

1. Estimation of solid waste generated by a domestic system (biodegradable and nonbiodegradable) and its impact on land degradation.
2. Collection of data on forest covers of specific area.
3. Measurement of dominance of woody species by DBH (diameter at breast height) method.
4. Calculation and analysis of ecological footprint.
5. Ecological modelling.

Suggested Readings

1. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

Course Code: BOT 261

Course Title: Industrial and Environmental Microbiology

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit I: Microbes and fermentation processes (14 lectures)

Scope of microbes in industry and environment

Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations. Components of a typical bioreactor, Types of bioreactors-laboratory, pilot scale and production fermenters; Constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter.

Unit II: Microbial production of industrial products (12 lectures)

Microorganisms involved, media, fermentation conditions, downstream processing and uses;

Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin)

Unit III: Microbial enzymes (10 lectures)

Microorganisms for industrial applications. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase).

Unit IV: Microbes and environment (14 lectures)

Distribution of microbes in air; Isolation of microorganisms from soil, air and water.

Water pollution, role of microbes in sewage and domestic waste water treatment systems.

Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality, check coliform and fecal coliform in water samples.

Unit V: Microbes in agriculture and Bioremediation. (10 lectures)

Biological fixation; Mycorrhizae; Bioremediation of contaminated soils. Isolation of root nodulating bacteria, arbuscular mycorrhizal colonization in plant roots.

Practical

Course Code: BOT (L) 261

Course Title: Lab: Industrial and Environmental Microbiology

1. Principles and functioning of instruments in microbiology laboratory
2. Hands on sterilization techniques and preparation of culture media.
3. Isolation of root nodulating bacteria
4. Arbuscular mycorrhizal colonization in plant roots
5. Study of the methods for staining of microorganisms
6. Hands on microbial fermentation for production of alcohols
7. A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.

Suggested Readings

1. Pelzar, M.J. Jr., Chen E.C. S., Krieg, N.R. (2010). Microbiology: An application based approach. Tata McGraw Hill Education Pvt. Ltd., Delhi.
2. Tortora, G.J., Funke, B.R., Case. C.L. (2007). Microbiology. Pearson Benjamin Cummings, San Francisco, U.S.A. 9th edition.

Course Code: **BOT 262**
 Course Title: **Biostatistics**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit I : Biostatistics (12 lectures)

Definition - statistical methods - basic principles. Variables -measurements, functions, limitations and uses of statistics.

Unit II: Collection of data primary and secondary (12 lectures)

Types and methods of data collection procedures - merits and demerits. Classification - tabulation and presentation of data – sampling methods.

Unit III: Measures of central tendency (14 lectures)

Mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation - merits and demerits; Co- efficient of variations.

Unit IV: Correlation (12 lectures)

Types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression.

Unit V: Statistical inference (10 lectures)

Hypothesis - simple hypothesis - student 't' test - chi square test.

PRACTICAL

Course Code: **BOT (L) 262**
 Course Title: **Lab: Biostatistics**

1. Calculation of mean, median and mode
2. Calculation standard deviation and standard error
3. Calculation of correlation coefficient values and finding out the probability
4. Calculation of Chi-square and t- tests.

Suggested Readings

1. Biostatistics, Danniel, W.W., 1987. New York, John Wiley Sons.
2. An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian Medical College, Vellore
3. Statistical Analysis of epidemiological data, Selvin, S., 1991. New York University Press.
4. Statistics for Biology, Boston, Bishop, O.N. Houghton, Mifflin.
5. The Principles of scientific research, Freedman, P. New York, Pergamon Press.
6. Statistics for Biologists, Campbell, R.C., 1998. Cambridge University Press.

GENERIC ELECTIVE COURSES

Course Code: BOT 311
Course Title: Biomolecules and Cell Biology

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit 1: Biomolecules (20 lectures)

Carbohydrates: Nomenclature and classification; Role of monosaccharide, Disaccharides, Oligosaccharides and polysaccharides (structural and storage); Isomers and derivatives of glucose.

Lipids: Definition and major classes of lipids and fatty acids. Fatty acids structure and functions; emulsification and saponification. General structures, functions and properties of lipids.

Proteins: Structure of amino acids; Peptide bonds; Levels of protein structure-primary, secondary, tertiary and quaternary.

Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids.

Unit II: Bioenergetics and Enzymes (10 lectures)

Laws of thermodynamics, concept of free energy, redox reactions. ATP: structure, its role as an energy currency molecule.

Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; mechanism of enzyme action (activation energy, lock and key hypothesis, induced-fit theory), enzyme inhibition and factors affecting enzyme activity.

Unit III: The cell and its membranes (8 lectures)

Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells.

Structure and function of plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport.

Unit IV: Cell organelles and membrane system (16 lectures)

Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus.

Cytoskeleton: Microtubules, microfilaments and intermediary filament.

Chloroplast, mitochondria and peroxisomes: Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast.

Endomembrane system: Structures and functions of endoplasmic reticulum, Golgi Apparatus and Lysosomes.

Unit V: Cell division (6 lectures)

Eukaryotic cell cycle, mitosis and meiosis.

PRACTICAL**Course Code: BOT(L) 311****Course Title: Lab: Biomolecules and Cell Biology****Biomolecules:**

1. Estimation of Glucose by Anthrone method.
2. Estimation of protein concentration Lowry's method.
3. Separation of plant pigments by paper chromatography method.
4. Separation of amino acids by paper chromatography method.

Cell biology:

4. Study of plant cell structure with the help of epidermal peel of Onion / *Rhoeo/ Crinum*.
5. Measurement of cell size by the technique of micrometry.
6. Counting the cells per unit volume with the help of haemocytometer. (Yeast/pollen grains).
7. Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique.
8. Study different stages of mitosis and meiosis.

Suggested Readings

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.
6. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
7. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
8. Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
9. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Course Code: BOT 321
Course Title: Archegoniate

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60**Unit I: Introduction (12 lectures)**

Unifying features of archegoniate; Transition to land habit; Alternation of generations.

Bryophytes general characteristics; Adaptations to land habit; Classification; Range of thallus organization.

Pteridophytes general characteristics; Classification; Early land plants (*Cooksonia* and *Rhynia*).

Unit II: Type Studies- Bryophytes (12 lectures)

Classification (up to family), morphology, anatomy, reproduction and evolutionary trends of *Marchantia*, *Anthoceros*, *Sphagnum* and *Funaria*; Ecological and economic importance of bryophytes with special reference to *Sphagnum*.

Unit III: Type Studies- Pteridophytes (12 lectures)

Classification (up to family), morphology, anatomy and reproduction of *Psilotum*, *Selaginella*, *Equisetum* and *Pteris* (Developmental details not to be included). Apogamy, and apospory, heterospory and seed habit, telome theory, stelar evolution; Ecological and economic importance.

Unit IV: Gymnosperms (12 lectures)

General characteristics, classification (up to family), morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum* (Developmental details not to be included); Ecological and economic importance.

UNIT V Paleobotany (12 lectures)

Geological time scale, fossil types and their formation, general account of dominant fossil flora of different ages, paleobotany in relation to exploration to taxonomy

Practical

Course Code: BOT (L) 321

Course Title: Lab: Archegoniate

1. **Marchantia**- Morphology of thallus, vertical section of thallus, whole mount of Gemmae (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides).
2. **Anthoceros**- Morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudocelaters, columella) (temporary slide), vertical section of thallus (permanent slide).
3. **Funaria**- Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema.
4. **Selaginella**- Morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobilus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide).
5. **Equisetum**- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide).
6. **Pteris**- Morphology, transverse section of rachis, vertical section of sporophyll, whole mount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide).
7. **Cycas**- Morphology (coralloid roots, bulbil, leaf), whole mount of microsporophyll, transverse section of coralloid root, transverse section of rachis, vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide).
8. **Pinus**- Morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle, transverse section of stem, longitudinal section of / transverse section of male cone, whole mount of microsporophyll, whole mount of Microspores (temporary slides), longitudinal section of female cone, tangential longitudinal section & radial longitudinal sections stem (permanent slide).
9. **Gnetum**- Morphology (stem, male & female cones), transverse section of stem, vertical section of ovule (permanent slide)
10. **Sphagnum**- Morphology of plant, whole mount of leaf (permanent slide only).
11. **Psilotum**- Study of specimen, transverse section of synangium (permanent slide).

Suggested Readings

1. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
2. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
4. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
5. Vanderpoorten, A. & Goffinet, B. (2009) Introduction to Bryophytes. Cambridge University Press.

Course Code: BOT 331
Course Title: Anatomy of Angiosperms

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60**Unit 1: Introduction and scope of Plant Anatomy (4 Lectures)**

Applications in systematics, forensics and pharmacognosy.

Unit 2: Structure and Development of Plant Body (18 Lectures)

Internal organization of plant body: Tissue systems, types of cells and tissues.

Development of plant body: Cytodifferentiation.

Classification of tissues; Simple and complex tissues (no phylogeny); cytodifferentiation of tracheary elements and sieve elements; Pits and plasmodesmata; adcrustation and incrustation, Ergastic substances. Hydathodes, cavities, lithocysts and laticifers.

Unit 3: Apical meristems (15 Lectures)

Evolution of concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corplus theory, cytohistological zonation); Types of vascular bundles; Structure of dicot and monocot stem. Origin, development, Structure of dicot and monocot leaf, Kranz anatomy. Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root.

Unit 4: Vascular Cambium and Wood (15 Lectures)

Structure, function and seasonal activity of cambium; Secondary growth in root and stem. Axially and radially oriented elements; Types of rays and axial parenchyma; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology. Development and composition of periderm, rhytidome and lenticels.

Unit 5: Adaptive and Protective Systems (8 Lectures)

Epidermal tissue system, cuticle, epicuticular waxes, trichoes (uni-and multicellular, glandular and non glandular, two examples of each), stomata (classification); Adcrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes.

Practical: Course Code: BOT (L) 331 Course Title: Anatomy of Angiosperms

1. Study of anatomical details through permanent slides/temporary stain mounts/ macerations museum specimens with the help of suitable examples.
2. Apical meristem of root, shoot and vascular cambium.
3. Distribution and types of parenchyma, collenchyma and sclerenchyma.
4. Xylem: Tracheary elements-tracheids, vessel elements; thickenings; perforation plates; xylem fibres

5. Wood: ring porous; diffuse porous; tyloses; heart- and sapwood.
6. Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres.
7. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular.
8. Root: monocot, dicot, secondary growth.
9. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels.
10. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy).
11. Adaptive Anatomy: xerophytes, hydrophytes.
12. Secretory tissues: cavities, lithocysts and laticifers.

Suggested Readings

1. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
3. Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.
4. Evert, R.F. (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc.

Course Code: BOT 341
Course Title: Plant Systematics

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: Lectures: 60

Unit 1: Plant Systematics (12 lectures)

Introduction to systematics; Plant identification, Classification, Nomenclature. Biosystematics. Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access.

Unit II: Concept and Botanical nomenclature (12 lectures)

Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary).

Botanical nomenclature; Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.

Unit III: Systems of classification (12 lectures)

Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series)

Unit IV: Modern taxonomy (12 lectures)

Biometrics, numerical taxonomy and cladistics
 Taxonomy in relation to palynology, cytology, phytochemistry and molecular data

Unit V: Phylogeny of Angiosperms (12 lectures)

Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram)

Practical Course Code: BOT (L) 341 Course Title: Lab: Plant Systematics

1. Study of vegetative and floral characters of 10 common locally available
2. Field visit (local)
3. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Suggested Readings

1. Singh, (2012). *Plant Systematics: Theory and Practice* Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
2. Jeffrey, C. (1982). *An Introduction to Plant Taxonomy*. Cambridge University Press, Cambridge.
3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). *Plant Systematics-A Phylogenetic Approach*. Sinauer Associates Inc., U.S.A. 2nd edition.
4. Maheshwari, J.K. (1963). *Flora of Delhi*. CSIR, New Delhi.
5. Radford, A.E. (1986). *Fundamentals of Plant Systematics*. Harper and Row, New York.

SKILL ENHANCEMENT COURSE

Course Code: BOT 531
Course Title: Floriculture

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Unit 1: Introduction and Nursery Management (12 Lectures)

History of gardening; Importance and scope of floriculture and landscape gardening.

Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

Unit II: Principles of Garden Designs: (8 Lectures)

English, Italian, French, Persian, Mughal and Japanese gardens;
 Landscaping places of Public Importance: Landscaping highways and Educational institutions.

Unit III: Commercial Floriculture: (10 Lectures)

Ornamental Plants: Flowering annuals; Herbaceous perennials and ornamental trees; Indoor gardening; Bonsai.

Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers.

Diseases and Pests of Ornamental Plants.

Suggested Readings

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. *Floriculture in India*. Allied Publishers.

Course Code: BOT 541

Course Title: Mushroom Culture Technology

| | | | |
|----------------|-------|-------|-------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Unit I: Introduction (8 lectures)

Types of edible mushrooms, .Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms.

Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content – Vitamins.

Research Centres -National level and Regional level.

Unit II: Cultivation Technology (12 lectures)

Pure culture: Medium, sterilization, preparation of spawn, multiplication.

Infrastructure: substrates (locally available), Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag.

Mushroom bed preparation; Factors affecting the mushroom bed preparation;

Low cost technology, Composting technology in mushroom production.

Unit III: Storage: and Marketing: (10 lectures)

Short-term storage, Long term Storage, drying, storage in salt solutions.

Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested Readings

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991), Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

CHEMISTRY HONOURS

| Semester | CORE COURSE (14) | Ability Enhancement Compulsory Course (AECC) (2) | Ability Enhancement Elective Course (AEEC) (2) (Skill Based) | Elective: Discipline Specific DSE (4) | Elective: Generic (GE) (4) |
|----------|--------------------------|--|--|---------------------------------------|-----------------------------|
| I | Inorganic Chemistry: I | English Communication | | | Inorganic I and Organic I |
| | Physical Chemistry: I | | | | |
| II | Organic Chemistry: I | Environmental Studies | | | Physical I and Organic II |
| | Physical Chemistry: II | | | | |
| III | Inorganic Chemistry: II | | Literature Survey/ Pharmaceutical Chemistry | | Physical II and Organic III |
| | Organic Chemistry: II | | | | |
| | Physical Chemistry: III | | | | |
| IV | Inorganic Chemistry: III | | Scientific Writing/ Project | | Inorganic Chemistry II |
| | Organic Chemistry: III | | | | |
| | Physical Chemistry: IV | | | | |
| V | Organic Chemistry: IV | | | Analytical Methods in Chemistry | |
| | Physical Chemistry: V | | | Green Chemistry | |
| VI | Inorganic Chemistry: IV | | | Research Methodology for Chemistry | |
| | Organic Chemistry: V | | | Project/ Dissertation | |

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|-------------------------|----------------|--------------|--------------|---------------|---------------|
| No. of Courses (Credit) | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |
|-------------------------|----------------|--------------|--------------|---------------|---------------|

I. CORE COURSE**Semester I**

Course Code: CHM 111
Course Title: Inorganic Chemistry-I

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY: 60 LECTURES**Atomic Structure:**

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2 . Quantum numbers and their significance. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

Periodicity of Elements:

s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block:

(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van der Waals) (c) Ionic and crystal radii. (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (f) Electron gain enthalpy, trends of electron gain enthalpy. (g) Electronegativity, Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.

3. Chemical Bonding I:

(i) Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

(ii) Covalent bond: Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2 , O_2 , C_2 , B_2 , F_2 , CO, NO, and their ions; HCl, BeF_2 , CO_2 , (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths.

4. Chemical Bonding II:

Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization.

Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.

(iii) Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.

(iv) Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility, energetics of dissolution process.

5. Oxidation-Reduction:

Redox equations, Standard Electrode Potential and its application to inorganic reactions.

Principles involved in volumetric analysis involving KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$, Oxalic acid, sodium thiosulphate, and Iodine; gram molecular weight, molarity, equivalent weight, normality, Normality equation, grams per liter.

References:

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970
3. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
4. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.

CHM(L) 111—Lab: Inorganic Chemistry-I

60 Lectures

(A) Titrimetric Analysis

(i) Calibration and use of apparatus (ii) Preparation of solutions of different Molarity/Normality of titrants

(B) Acid-Base Titrations

(i) Estimation of carbonate and hydroxide present together in mixture. (ii) Estimation of carbonate and bicarbonate present together in a mixture. (iii) Estimation of free alkali present in different soaps/detergents

(C) Oxidation-Reduction Titrimetry

(i) Estimation of Fe(II) and oxalic acid using standardized KMnO_4 solution. (ii) Estimation of oxalic acid and sodium oxalate in a given mixture. (iii) Estimation of Fe(II) with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

References:

Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.

Course Code: CHM 112
Course Title: PHYSICAL CHEMISTRY-I

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures

1. Gaseous State I

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity; variation of viscosity with temperature and pressure.

Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartitions of energy and degrees of freedom.

2. Gaseous State II

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, Z , and its variation with pressure for different gases. Causes of deviation from ideal behaviour. Van der Waals equation of state, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dietrici); virial equation of state. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

3. Liquid State

Qualitative treatment of the structure of the liquid state (Vacancy model of liquid); Radial distribution function; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination (Static and Dynamic methods; Capillary Rise method and Drop Number method; Ostwald's method), Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases.

4. Solid State

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law. A simple account of rotating crystal method and powder pattern method, Analysis of powder diffraction pattern of NaCl and KCl, Defects in crystals. Glasses and liquid crystals.

5. Ionic Equilibria

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect;

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications, Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations.

References:

Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 10th Ed., Oxford University Press 13(2006).
Ball, D. W. Physical Chemistry Thomson Press, India (2007).
Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
Gurdeep Raj., Advanced Physical Chemistry, 39th Ed, Goel Publishing House (2014).
Puri, Sharma and Pathania., Principles of Physical Chemistry, 46th Ed, Vishal Publishing Co.(2012).

Course Code: CHM(L) 112 Course Title: Physical Chemistry - I**60 Lectures****Surface tension measurements**

1. Determine the surface tension by (i) drop number (ii) drop weight method.
2. Study the variation of surface tension of detergent solutions with concentration.

Viscosity measurement using Ostwald's viscometer

3. Determination of viscosity of aqueous solutions of (i) ethanol and (ii) sugar at room temperature.
4. Study the variation of viscosity of sucrose solution with the concentration of solute.

pH metry

5. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
6. Preparation of buffer solutions of different pH
 - a) Sodium acetate-acetic acid
 - b) Ammonium chloride-ammonium hydroxide
7. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
8. Determination of dissociation constant of a weak acid.

References:

Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W. H. Freeman & Co.: New York (2003).
Nad, A.K., Mahapatra, B., Ghoshal, A., An Advanced Course in Practical Chemistry, New Central Book Agency (P) Ltd., Kolkata, India.
Das, Subhas C., Advanced Practical Chemistry for 3-Year Honours Course.

Semester II

Course Code: CHM 121
 Course Title: ORGANIC CHEMISTRY- I

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|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures

1. Basics of Organic Chemistry

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties.

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Homolytic and Heterolytic fission with suitable examples; Electrophiles and Nucleophiles; Nucleophilicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

2. Chemistry of Aliphatic Hydrocarbons

Carbon-Carbon sigma bonds; Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions:

Carbon-Carbon pi bonds; Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, reactions. Saytzeff and Hofmann eliminations. *Reactions of alkenes*: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation, ozonolysis, reduction (catalytic and chemical) 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethylbenzene.

3. Alkynes, Cycloalkanes and Conformational Analysis

Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes

Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.

4. Alkynes, Cycloalkanes and Conformational Analysis

Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.

5. Stereochemistry

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules.

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution.

Relative and absolute configuration: D/L and R/S designations.

References:

- Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Eliel, E. L. & Wilen, S. H. *Stereochemistry of Organic Compounds*, Wiley: London, 1994.
- Kalsi, P. S. *Stereochemistry Conformation and Mechanism*, New Age International, 2005.
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- Arun Bahl, B. S. Bahl, A text book of organic chemistry, latest Ed. S. Chand, New Delhi

Practical

60 Lectures

Course Code: CHM(L) 121 -

Course Title: Organic Chemistry—I

1. Purification of organic compounds by crystallization using the following solvents:
 - a. Water
 - b. Alcohol
 - c. Alcohol-Water
2. Determination of the melting points of unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
3. Chromatography

Paper chromatographic separation and determination of R_f values of mixture of any two or three amino acids from their mixture (alanine, glycine and leucine or any other set). Spray reagent: Ninhydrin.

Separation of a mixture of two sugars by ascending paper chromatography

Separation of a mixture of organic compounds by thin layer chromatography (TLC)

References:

- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
- Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012)

Course Code: CHM 122
Course Title: PHYSICAL CHEMISTRY- II
Theory: 60 Lectures

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| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

1. Chemical Thermodynamics I

Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics.

First law: Concept of heat, q , work, w , internal energy, U , and statement of first law; enthalpy, H , relation between heat capacities, calculations of q , w , U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.

Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for different processes.

2. Chemical Thermodynamics-II

Third Law: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules.

Thermochemistry: Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; Hess' law of constant summation, calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, Explosion temperature.

3. Free Energy Functions and Systems of Variable Composition:

Free Energy Functions: Gibbs and Helmholtz energy; variation of S , G , A with T , V , P ; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

Systems of Variable Composition: Partial molar quantities; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

4. Chemical Equilibrium

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exoergic and endoergic reactions, Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. thermodynamic derivation of relations between the various equilibrium constants K_p , K_c and K_x . Le Chatelier principle (quantitative treatment)

5. Solutions and Colligative Properties:

Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Excess thermodynamic functions, Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

References:

- Peter, A. & Paula, J. de. *Physical Chemistry* 10th Ed., Oxford University Press (2014).
Castellan, G. W. *Physical Chemistry 4th Ed.*, Narosa (2004).
Engel, T. & Reid, P. *Physical Chemistry 3rd Ed.*, Prentice-Hall (2012).
McQuarrie, D. A. & Simon, J. D. *Molecular Thermodynamics* Viva Books Pvt. Ltd.: New Delhi (2004).
Assael, M. J.; Goodwin, A. R. H.; Stamatoudis, M.; Wakeham, W. A. & Will, S. *Commonly Asked Questions in Thermodynamics*. CRC Press: NY (2011).
Levine, I. N. *Physical Chemistry* 6th Ed., Tata Mc Graw Hill (2010).
Metz, C.R. *2000 solved problems in chemistry*, Schaum Series (2006).

Practical

60 Lectures

Course Code: CHM(L) 122

Course Title: Physical Chemistry -II

Thermochemistry

1. Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).
2. Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.
4. Determination of enthalpy of hydration of copper sulphate.
5. Calculation of the enthalpy of ionization of ethanoic acid.
6. Study of the solubility of benzoic acid in water and determination of ΔH .

References:

1. Khosla, B. D.; Garg, V. C. & Gulati, A., *Senior Practical Physical Chemistry*, R. Chand & Co.:New Delhi (2011).
2. Athawale, V. D. & Mathur, P. *Experimental Physical Chemistry* New Age International: New Delhi (2001).

Semester III

Course Code: CHM 131

Course Title: INORGANIC CHEMISTRY-II

Theory: 60 Lectures

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|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

1. General Principles of Metallurgy

General Principles of Metallurgy: Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy. Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkel-de Boer process and Mond's process, Zone refining.

2. Acids and Bases:

Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle.

3. Chemistry of s and p Block Elements I:

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of s block elements.

Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate.

4. Chemistry of s and p Block Elements II:

Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses.

Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens.

5. Noble gases and Inorganic Polymers:

Noble Gases: Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF₂, XeF₄ and XeF₆; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF₂). Molecular shapes of noble gas compounds (VSEPR theory).

Inorganic Polymers: Types of inorganic polymers and comparison with organic polymers, Synthesis, structural aspects, and applications of silicates, silicones, and phosphazenes.

References:

- Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
 Douglas, B.E; Mc Daniel, D.H. & Alexander, J.J. Concepts & Models of Inorganic Chemistry 3rd Ed., John Wiley Sons, N.Y. 1994.
 Greenwood, N.N. & Earnshaw. Chemistry of the Elements, ButterworthHeinemann. 1997.
 Cotton, F.A. & Wilkinson, G. Advanced Inorganic Chemistry, Wiley, VCH, 1999.
 Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.
 Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry 4th Ed., Pearson, 2010.
 Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).

Practical**COURSE CODE: CHM 131 (LAB)****COURSE TITLE: INORGANIC CHEMISTRY II (LAB)****(Credits: 2, Lectures: 60)****(A) Iodo / Iodimetric Titrations**

- (i) Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution (Iodimetrically). (ii) Estimation of (i) arsenite and (ii) antimony in tartar-emetic iodimetrically (iii) Estimation of available chlorine in bleaching powder iodometrically.

(B) Inorganic preparations

- (i) Cuprous Chloride, Cu_2Cl_2
 (ii) Preparation of Manganese(III) phosphate, $MnPO_4 \cdot H_2O$
 (iii) Preparation of Aluminium potassium sulphate $KAl(SO_4)_2 \cdot 12H_2O$ or Chrome alum.

References:

Course Code: CHM 132
Course Title: ORGANIC CHEMISTRY-II

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures**1. Chemistry of Halogenated Hydrocarbons**

Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN_1 , SN_2 and SN_i mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination.

Aryl halides: Preparation, including preparation from diazonium salts. Nucleophilic aromatic substitution; SN_{Ar} , Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

2. Alcohols and Phenols

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement;

Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe’s–Schmidt Reactions, Fries and Claisen rearrangements with mechanism.

3. Ethers, Epoxides and Sulphur Containing Compounds

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH₄.

Preparation and reactions of thiols, thioethers and sulphonic acids.

4. Carbonyl Compound

Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic addition elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, α -substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, LiAlH₄, NaBH₄, MPV. Addition reactions of unsaturated carbonyl compounds: Michael addition.

5. Carboxylic Acids and their Derivatives

Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, tartaric, citric and fumaric acids; Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group -Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmannbromamide degradation and Curtius rearrangement.

References:

Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Graham Solomons, T. W. Organic Chemistry, John Wiley & Sons, Inc.

Arun Bahl, B. S. Bahl, A text book of organic chemistry, latest Ed. S. Chand, New Delhi.

M. K. Jain, S. C. Sharma, Organic Chemistry, Latest Ed. Shoban Lal Nagin Chand, .

Practical**COURSE CODE: CHM 132 (LAB)****COURSE TITLE: ORGANIC CHEMISTRY II (LAB)****(Credits: 2, Lectures: 60)**

1. Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.
2. Organic preparations:
 - A. Acetylation of one of the following compounds: amines (aniline, *o*-, *m*-, *p*-toluidines and *o*-, *m*-, *p*-anisidine) and phenols (β -naphthol, vanillin, salicylic acid) by any one method: (i) Using conventional method, (ii) Using green approach
 - B. Benzoylation of one of the following amines (aniline, *o*-, *m*-, *p*-toluidines and *o*-, *m*-, *p*-anisidine) and one of the following phenols (β -naphthol, resorcinol, *p*-cresol) by Schotten- Baumann reaction.
 - C. Bromination of any one of the following: (i) Acetanilide by conventional methods, (ii) Acetanilide using green approach (Bromate-bromide method)
 - D. Nitration of any one of the following: (i) Acetanilide/nitrobenzene by conventional method (ii) Salicylic acid by green approach (using ceric ammonium nitrate).

The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, mp and TLC.

Reference Books

1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
 2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012)
 3. Ahluwalia, V. K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*, University Press (2000).
 4. Ahluwalia, V. K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis*, University Press (2000).
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Course Code: CHM 133
Course Title: PHYSICAL CHEMISTRY-III

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|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures

1. Phase Equilibria I

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria, Reduced phase rule (definition), phase diagram for one component systems, (H₂O system). Phase diagrams for systems of solid-liquid equilibria involving eutectic (KI-H₂O system), congruent (Mg-Zn system) and incongruent melting points (NaCl-H₂O system).

2. Phase Equilibria II

Two component system of solid solution (Pb-Ag), Three component systems, water-chloroform-acetic acid system, triangular plots.

Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and nonideal), azeotropes, Lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation. Nernst distribution law: its derivation and applications.

3. Chemical Kinetics I

Order and molecularity of a reaction, factors affecting rate of reaction, determination of rate laws, derivation of integrated rate law expression upto second order reactions. Pseudo order reaction, Half life time of reactions (First order to nth order); Determination of order of reaction (integrated, differential, graphical and half life period method) .

4. Chemical Kinetics II

Kinetics of complex reactions; opposing reactions, parallel reactions, consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms), chain reactions. Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Activated complex Theory.

5. Catalysis And Surface Chemistry

Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

Surface chemistry: Physical adsorption, chemisorption, adsorption isotherms. nature of adsorbed state. Factors affecting adsorption, Freundlich adsorption isotherm derivation, Langmuir adsorption isotherm.

References:

- Peter Atkins & Julio De Paula, *Physical Chemistry* 10th Ed., Oxford University Press (2014).
 Castellan, G. W. *Physical Chemistry*, 4th Ed., Narosa (2004).
 McQuarrie, D. A. & Simon, J. D., *Molecular Thermodynamics*, Viva Books Pvt. Ltd.: New Delhi (2004).
 Engel, T. & Reid, P. *Physical Chemistry 3rd Ed.*, Prentice-Hall (2012).
 Mortimer, R. G. *Physical Chemistry 3rd Ed.*, Elsevier: NOIDA, UP (2009).
 Levine, I. N. *Physical Chemistry 6th Ed.*, Tata McGraw-Hill (2011).
 Metz, C. R. *Physical Chemistry 2nd Ed.*, Tata McGraw-Hill (2009).
 Gurdeep Raj., *Advanced Physical Chemistry*, 39th Ed, Goel Publishing House (2014).
 Puri, Sharma and Pathania., *Principles of Physical Chemistry*, 46th Ed, Vishal Publishing Co. (2012).

Practical

60 Lectures

Course Code: CHM(L) 133 Course Title: Physical Chemistry-III

Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

Distribution of acetic/ benzoic acid between water and cyclohexane.

Study the kinetics of the following reactions.

Acid hydrolysis of methyl acetate with hydrochloric acid.

Saponification of ethyl acetate.

Compare the strengths of HCl and H₂SO₄ by studying kinetics of hydrolysis of methylacetate.

Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.

Phase equilibria: Construction of the phase diagram using cooling curves or ignition tube method:

simple eutectic and

congruent melting systems.

References:

- Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
 Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).

Semester IV

Course Code: CHM 141
 Course Title: INORGANIC CHEMISTRY-III

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|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures

1. Transition Elements:

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer & Frost diagrams). Difference between the first, second and third transition series. Chemistry of Ti, V, Cr Mn, Fe and Co in stable oxidation states (excluding their metallurgy).

2. Coordination Chemistry I:

Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of $10 Dq$ (Δ_o), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of $10 Dq$ (Δ_o , Δ_t). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry. Qualitative aspect of Ligand field and MO Theory.

3. Coordination Chemistry II:

IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes.

4. Lanthanides and Actinides: Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

5. Bioinorganic Chemistry:

Metal ions present in biological systems, classification of elements according to their action in biological system. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine.

Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.

References:

- Purcell, K.F & Kotz, J.C. Inorganic Chemistry W.B. Saunders Co, 1977.
Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry Wiley-VCH, 1999
Basolo, F, and Pearson, R.C. Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
Greenwood, N.N. & Earnshaw A. Chemistry of the Elements, Butterworth Heinemann, 1997

Practical**60 Lectures****Course Code: CHM(L) 141****Course Title: Inorganic Chemistry—III****Gravimetric Analysis**

- i. Estimation of nickel (II) using Dimethylglyoxime (DMG).
- ii. Estimation of copper as CuSCN
- iii. Estimation of iron as Fe₂O₃ by precipitating iron as Fe(OH)₃.
- iv. Estimation of Al (III) by precipitating with oxine and weighing as Al(oxine)₃ (aluminium oxinate).

Inorganic Preparations

- i. Tetraamminecopper (II) sulphate, [Cu(NH₃)₄]SO₄.H₂O
- ii. *Cis* and *trans* K[Cr(C₂O₄)₂. (H₂O)₂] Potassium dioxalatodiaquachromate (III)
- iii. Tetraamminecarbonatocobalt (III) ion
- iv. Potassium tris(oxalate)ferrate(III)

Chromatography of metal ions

Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions:

- i. Ni (II) and Co (II)
- ii. Fe (III) and Al (III)

Reference Book:

Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.

Course Code: CHM 142
Course Title: ORGANIC CHEMISTRY-III

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures

1. Nitrogen Containing Functional Groups

Preparation and important reactions of nitro and compounds, nitriles and isonitriles Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbyl-amine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid. Diazonium Salts: Preparation and their synthetic applications

2. Polynuclear Hydrocarbons

Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene

3. Alkaloids

Natural occurrence, General structural features, Isolation and their physiological action. Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

4. Heterocyclic Compounds I

Classification and nomenclature, Molecular Orbital structure, aromaticity in 5-numbered and 6- membered rings containing one heteroatom; Comparison of basicity of pyridine, piperidine and pyrrole. Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole, Fischer indole synthesis and Madelung synthesis).

5. Heterocyclic Compounds II & Terpenes

Structure elucidation of quinoline and isoquinoline, Skraup synthesis, Knorr quinoline synthesis, Bischler-Napieralski reaction, DoebnerMiller synthesis.

Terpenes: Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral, Neral and α -terpineol.

References:

- Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Welly & Sons (1976).
5. Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.
6. Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd.
7. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.
8. Singh, J.; Ali, S. M. & Singh, J. Natural Product Chemistry, Prajati Parakashan (2010).

Practical**60 Lectures****Course Code: CHM(L) 142****Course Title: Organic Chemistry– III****Qualitative Organic analysis**

Detection of elements (N, S and halogens) and functional groups, determination of melting points and preparation of suitable derivatives to identify the given organic compounds (Preferable by capillary method)

References:

1. Mann, F. G. & Saunders, B. C. Practical Organic Chemistry, Pearson Education (2009).
2. Furniss, B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A. R. Practical Organic Chemistry, 5th Ed., Pearson (2012).
3. Ahluwalia, V. K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
4. Ahluwalia, V. K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

Course Code: CHM 143
Course Title: PHYSICAL CHEMISTRY-IV

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures**1. Conductance I**

Arrhenius theory of electrolytic dissociation and its limitations. Conductivity (equivalent and molar conductivity) and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Measurement of conductance, Kohlrausch law of independent migration of ions. Ostwald's dilution law, its uses and limitations, Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules.. Determination of transport numbers using Hittorf and Moving Boundary methods.

2. Conductance II

Activity coefficients of electrolytes, Mean ionic coefficient, Applications of conductance measurement: (i) degree of dissociation of weak electrolytes (numerical problems), (ii) ionic product of water (numerical problems) (iii) solubility and solubility product of sparingly soluble salts (numerical problems), (iv) conductometric titrations –different types, and (v) hydrolysis constants of salts.

3. Electrochemistry I

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry. Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half cells. Decomposition potential, overvoltage, corrosion.

4. Electrochemistry II

Types of electrodes: Metal-metal ion electrodes, metal-metal insoluble salt electrodes, metal-amalgam electrodes, redox electrodes, calomel-electrode. Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass and Sb/Sb₂O₃ electrodes, Concentration cells with and without transference, liquid-junction potential, Determination of activity coefficients and transference numbers, Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).

5. Electrical And Magnetic Properties

Basic ideas of electrostatics, Electrostatics of dielectric media, Dielectric polarization and dielectric constant, electric polarization of molecules, Clausius-Mosotti equation, Lorenz-Laurentz equation, Dipole moment and molecular polarizabilities and their measurements. Diamagnetism, paramagnetism, magnetic susceptibility and its measurement.

References:

- Peter Atkins & Julio De Paula, *Physical Chemistry* 10th Ed., Oxford University Press (2014).
Castellan, G. W. *Physical Chemistry*, 4th Ed., Narosa (2004).
McQuarrie, D. A. & Simon, J. D., *Molecular Thermodynamics*, Viva Books Pvt. Ltd.: New Delhi (2004).
Engel, T. & Reid, P. *Physical Chemistry 3rd Ed.*, Prentice-Hall (2012).
Mortimer, R. G. *Physical Chemistry 3rd Ed.*, Elsevier: NOIDA, UP (2009).
Levine, I. N. *Physical Chemistry 6th Ed.*, Tata McGraw-Hill (2011).
Metz, C. R. *Physical Chemistry 2nd Ed.*, Tata McGraw-Hill (2009).
Gurdeep Raj., *Advanced Physical Chemistry*, 39th Ed, Goel Publishing House (2014).
Puri, Sharma and Pathania., *Principles of Physical Chemistry*, 46th Ed, Vishal Publishing Co. (2012).

Practical**60 Lectures****Course Code: CHM (L) 143 Course Title: Physical Chemistry—IV****1. Conductometry**

Determination of cell constant

Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

Perform the following conductometric titrations:

Strong acid vs. strong base

Weak acid vs. strong base

Mixture of strong acid and weak acid vs. strong base

Strong acid vs. weak base

2. Potentiometry

Perform the following potentiometric titrations:

Strong acid vs. strong base

Weak acid vs. strong base

Dibasic acid vs. strong base

Potassium dichromate vs. Mohr's salt

References:

1. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).
3. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.*; W.H. Freeman & Co.: New York (2003).
Freeman & Co.: New York (2003).

Semester V

Course Code: CHM 151
Course Title: ORGANIC CHEMISTRY-IV

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures**1. Nucleic Acids**

Components of nucleic acids, Nucleosides and nucleotides; Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine; Structure of polynucleotides.

2. Amino Acids, Peptides and ProteinsAmino acids, Peptides and their classification. α -Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, pK_a values, isoelectric point and electrophoresis; Study of peptides: determination

of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using Nprotecting, C-protecting and C-activating groups -Solid-phase synthesis

3. Enzymes

Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes. Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and noncompetitive inhibition including allosteric inhibition).

4. Lipids and Concept of Energy in Biosystems

Lipids: Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity.

Concept of Energy in Biosystems: Cells obtain energy by the oxidation of foodstuff (organic molecules). Introduction to metabolism (catabolism, anabolism). ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change. Agents for transfer of electrons in biological redox systems: NAD^+ , FAD. Conversion of food to energy: Outline of catabolic pathways of carbohydrate-glycolysis, fermentation, Krebs cycle. Overview of catabolic pathways of fat and protein. Interrelationship in the metabolic pathways of protein, fat and carbohydrate. Caloric value of food, standard caloric content of food types.

5. Pharmaceutical Compounds: Structure and Importance

Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of vitamin C and antacid (ranitidine).

References:

- Berg, J. M., Tymoczko, J. L. and Stryer, L. Biochemistry. 6th Edition. W. H. Freeman and Co (2006).
Nelson, D. L., Cox, M. M. and Lehninger, A. L. Principles of Biochemistry. 4th Edition. W. H. Freeman and Co (2009).
Murray, R. K., Granner, D. K., Mayes, P. A. and Rodwell, V. W. Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/ McGraw-Hill (2009).
Arun Bahl, B. S. Bahl, A text book of organic chemistry, latest Ed. S. Chand, New Delhi.
M. K. Jain, S. C. Sharma, Organic Chemistry, Latest Ed. Shoban Lal Nagin Chand, Jalandhar

Practical**60 Lectures****Course Code: CHM(L) 151****Course Title: : Organic Chemistry– IV**

1. Estimation of glycine by Sorenson's formalin method.
2. Study of the titration curve of glycine.
3. Estimation of proteins by Lowry's method.
4. Study of the action of salivary amylase on starch at optimum conditions.
5. Effect of temperature on the action of salivary amylase.
6. Saponification value of an oil or a fat.
7. Determination of Iodine number of an oil/ fat.
8. Isolation and characterization of DNA from onion/ cauliflower/peas.
9. Estimation of glucose/cholesterol/ urea/uric acid by colorimeter by chemical methods.

References:

Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi.
Arthur, I. V. *Quantitative Organic Analysis*, Pearson

Course Code: CHM 152
Course Title: PHYSICAL CHEMISTRY V

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures**1. Quantum Chemistry I**

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box", quantization of energy levels, zero point energy and Heisenberg Uncertainty principle; wave functions, probability distribution functions, Extension to two and three dimensional boxes , degeneracy.

Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wave functions. Vibrational energy of diatomic molecules. Rigid rotator model of rotation of diatomic molecule. transformation to spherical polar coordinates. Separation of variables.

2. Quantum Chemistry II

Setting up of Schrödinger equation for many-electron atoms (He). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).

Chemical bonding: Covalent bonding, Valence bond and Molecular orbital approaches, LCAO-MO

3. Molecular Spectroscopy I

Interaction of electromagnetic radiation with molecules and various types of spectra; Born- Oppenheimer approximation.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic molecules.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, fundamental frequencies, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

4. Molecular Spectroscopy II

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Vibrational Raman spectra, Stokes and anti- Stokes lines; their intensity difference, rule of mutual exclusion.

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and pre- dissociation, calculation of electronic transitions of polyenes using free electron model.

5. Photochemistry

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitized reactions, Quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.

References:

- Banwell, C. N. & McCash, E. M., Fundamentals of Molecular Spectroscopy, 4th Ed. Tata McGraw-Hill: New Delhi (2006).
Chandra, A. K., Introductory Quantum Chemistry, Tata McGraw-Hill.
House, J. E., Fundamentals of Quantum Chemistry, 2nd Ed. Elsevier: USA.
Lowe, J. P. & Peterson, K., Quantum Chemistry, Academic Press (2005).
Kakkar, R., Atomic & Molecular Spectroscopy, Cambridge University Press.
Macqure, D. A., Quantum Chemistry.
Atkins, Peter W. and Friedman, Ronald S., Molecular Quantum Mechanics, 5th Edition.

Course Code: CHM(L) 152

Course Title: Lab: Physical Chemistry V

60 Lectures

Colorimetry

Study the kinetics of iodination of propanone in acidic medium.

Determine the amount of iron present in a sample using 1,10-phenanthroline.

Determine the dissociation constant of an indicator (phenolphthalein).

Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.

Analysis of the given vibration-rotation spectrum of HCl(g)

UV/Visible spectroscopy

Study the 200-500 nm absorbance spectra of KMnO₄ and K₂Cr₂O₇ (in 0.1 M H₂SO₄) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule⁻¹, kJ mol⁻¹, cm⁻¹, eV).

Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of K₂Cr₂O₇.

Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.

References:

- Khosla, B. D.; Garg, V. C. & Gulati, A., *Senior Practical Physical Chemistry*, R. Chand & Co.:New Delhi (2011).
- Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).
- Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.*; W.H. Freeman & Co.: New York (2003).

Semester VI

Course Code: CHM 161
 Course Title: INORGANIC CHEMISTRY-IV

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|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures

1. Theoretical Principles in Qualitative Analysis (H₂S Scheme)

Basic principles involved in analysis of cations and anions and solubility products, common ion effect. Principles involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II.

2. Organometallic Compounds I:

Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π -acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

3. Organometallic Compounds II:

Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls. Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds. Role of triethylaluminium in polymerisation of ethene (Ziegler – Natta Catalyst). Species present in ether solution of Grignard reagent and their structures, Schlenk equilibrium. Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that of benzene.

4. Reaction Kinetics and Mechanism

Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans- effect, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic stability, Kinetics of octahedral substitution, Ligand field effects and reaction rates, Mechanism of substitution in octahedral complexes.

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5. Catalysis by Organometallic Compounds

Study of the following industrial processes and their mechanism: 1. Alkene hydrogenation (Wilkinsons Catalyst) 2. Hydroformylation (Co salts) 3. Wacker Process 4. Synthetic gasoline (Fischer Tropsch reaction) 5. Synthesis gas by metal carbonyl complexes.

Reference Books:

1. Cotton, F.A.G.; Wilkinson & Gaus, P.L. Basic Inorganic Chemistry 3rd Ed.; Wiley India,
2. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006.
3. Sharpe, A.G. Inorganic Chemistry, 4th Indian Reprint (Pearson Education) 2005
4. Douglas, B. E.; McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry 3rd Ed., John Wiley and Sons, NY, 1994.
5. Greenwood, N.N. & Earnshaw, A. Chemistry of the Elements, Elsevier 2nd Ed, 1997
6. Lee, J.D. Concise Inorganic Chemistry 5th Ed., John Wiley and sons 2008.
7. Powell, P. Principles of Organometallic Chemistry, Chapman and Hall, 1988.
8. Shriver, D.D. & P. Atkins, Inorganic Chemistry 2nd Ed., Oxford University Press, 1994.
9. Basolo, F. & Pearson, R. Mechanisms of Inorganic Reactions: Study of Metal Complexes in Solution 2nd Ed., John Wiley & Sons Inc; NY.
10. Purcell, K.F. & Kotz, J.C., Inorganic Chemistry, W.B. Saunders Co. 1977
11. Miessler, G. L. & Tarr, D.A. Inorganic Chemistry 4th Ed., Pearson, 2010.
12. Collman, J. P. et al. Principles and Applications of Organotransition Metal Chemistry. Mill Valley, CA: University Science Books, 1987.
13. Crabtree, R. H. The Organometallic Chemistry of the Transition Metals. j New York, NY: John Wiley, 2000.
14. Spessard, G.O. & Miessler, G.L. Organometallic Chemistry. Upper Saddle River, NJ: Prentice-Hall, 1996.

Course Code: CHM(L) 161 Course Title: Inorganic Chemistry—IV

60 Lecture

1. Qualitative semimicro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested: CO_3^{2-} , NO_2^- , S^{2-} , SO_3^{2-} , $\text{S}_2\text{O}_3^{2-}$, CH_3COO^- , F^- , Cl^- , Br^- , I^- , NO_3^- , BO_3^{3-} , $\text{C}_2\text{O}_4^{2-}$, PO_4^{3-} , NH_4^+ , K^+ , Pb^{2+} , Cu^{2+} , Cd^{2+} , Bi^{3+} , Sn^{2+} , Sb^{3+} , Fe^{3+} , Al^{3+} , Cr^{3+} , Zn^{2+} , Mn^{2+} , Co^{2+} , Ni^{2+} , Ba^{2+} , Sr^{2+} , Ca^{2+} , Mg^{2+} Mixtures should preferably contain one interfering anion, or insoluble component (BaSO_4 , SrSO_4 , PbSO_4 , CaF_2 or Al_2O_3) or combination of anions e.g. CO_3^{2-} and SO_3^{2-} , NO_2^- and NO_3^- , Cl^- and Br^- , Cl^- and I^- , Br^- and I^- , NO_3^- and Br^- , NO_3^- and I^- . Spot tests should be done whenever possible.
2. Controlled synthesis of two copper oxalate hydrate complexes: kinetic vs thermodynamic factors.
3. Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g. bidentate ligands like acetylacetonate, DMG, glycine) by substitution method.

References:

1. Vogel's Qualitative Inorganic Analysis, Revised by G. Svehla. Pearson Education, 2002.
2. Marr & Rockett Practical Inorganic Chemistry. John Wiley & Sons 1972.

Course Code: CHM 162
Course Title: ORGANIC CHEMISTRY-V

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures

1. Carbohydrates

Occurrence, classification and their biological importance. Monosaccharides: Constitution of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation; Disaccharides – Structure elucidation of maltose and sucrose. Polysaccharides – Elementary treatment of starch, cellulose.

2. Dyes

Classification, Colour and constitution; Mordant and Vat Dyes; Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red (mechanism of Diazo Coupling); Triphenyl Methane Dyes - Malachite Green, Rosaniline and Crystal Violet; Phthalein Dyes – Phenolphthalein and Fluorescein; Natural dyes : synthesis of Alizarin and Indigotin.

3. Polymers

Introduction and classification of polymers; Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polydispersity Index. Polymerisation reactions- Addition and condensation- Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes; Preparation and applications of plastics– thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene); Fabrics – natural and synthetic fabrics (acrylic, polyester); Rubbers – natural and synthetic rubbers: Buna-S, Chloroprene and Neoprene; Vulcanization.

4. Pericyclic reactions

Introduction to Pericyclic reactions; Molecular orbitals;

Electrocyclic reactions: Introduction, Stereochemistry of electrocyclic reactions, Conrotatory- disrotatory ring closure and ring opening (with examples: 1,4-(2E, 4E) hexatriene, 1, 4-(2E, 4Z) hexatriene, (2E, 4Z, 6Z) Octatriene, (2E, 4Z, 6E) Octatriene. Woodward Hoffmanns rule for electrolytic reactions, Frontier Molecular orbital theory (no correlation diagram required)

Cycloaddition reaction: Dienes and Dinophiles, Supra-supra, Antara-antara modes of cycloadditions [4+2] Diels-Alder reaction and [2+2] Cycloaddition reaction.

5. Organometallic and Active Methylene Compounds

Organometallic compounds- Formation of Grignard reagent, Synthesis of alkanes, Alcohols, Carboxylic acids, Aldehydes, Ketones and Amines with Grignard's reagent; Organolithium compounds- preparation and synthesis of Alkyl Lithium.

Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.

References:

- Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.
Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
Billmeyer, F. W. Textbook of Polymer Science, John Wiley & Sons, Inc.
Gowariker, V. R.; Viswanathan, N. V. & Sreedhar, J. Polymer Science, New Age International (P) Ltd. Pub.
Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.
Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.
Singh, J.; Ali, S.M. & Singh, J. Natural Product Chemistry, Prajati Prakashan (2010).
Arun Bahl, B. S. Bahl, A text book of organic chemistry, latest Ed. S. Chand, New Delhi

Course Code: CHM(L) 162**60 Lectures****Course Title: Organic Chemistry – V**

1. Extraction of caffeine from tea leaves.
2. Preparation of sodium polyacrylate.
3. Preparation of urea formaldehyde.
4. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.
5. Preparation of methyl orange.

References:

- Vogel, A.I. Quantitative Organic Analysis, Part 3, Pearson (2012).
Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education, (2009).
Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012).
Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

II. DISCIPLINE SPECIFIC ELECTIVE COURSE (DSEC)

Course Code: CHM 251
 Course Title: ANALYTICAL METHODS IN CHEMISTRY

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures

1. Qualitative and quantitative aspects of analysis and Thermal analysis:

Qualitative and quantitative aspects of analysis: Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Thermal Analysis: Theory of thermogravimetry (TG): Basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

2. Flame Atomic Absorption and Emission spectroscopy:

General principles Introduction to absorption and emission spectroscopy. Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

3. Electrochemical methods and Stereoisomeric Analysis:

Electroanalytical methods: Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

Stereoisomeric analysis: Measurement of optical rotation, calculation of Enantiomeric excess (ee), determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents.

4. Separation techniques:

Solvent extraction: Classification, principle and efficiency of the technique.

Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and nonaqueous media.

Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods. Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

4. Radioanalytical Methods:

Activation analysis. Neutron activation analysis, principles, techniques, steps involved, important applications. Radiometric titration: principles, techniques based upon complex formation and precipitation, radiometric titration curves for estimation of ions from their mixture.

Reference Books:

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009. Svehla, G. Vogel's Qualitative Inorganic Analysis, 7th Edition, Prentice Hall, 1996.
2. Willard, H.H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, D.C.: Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.
6. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
7. Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
8. Ditts, R.V. Analytical Chemistry; Methods of separation, van Nostrand, 1974

Course Code: CHM(L) 251 Course Title: Analytical Methods in Chemistry

60 Lectures

1. Separation Techniques

I. Chromatography:

- (i) Paper chromatographic separation of Fe^{3+} , Al^{3+} , and Cr^{3+} .
- (ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the R_f values.
- (iii) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their R_f values.
- (iv) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

II. Solvent Extractions:

- (i) To separate a mixture of Ni^{2+} & Fe^{2+} by complexation with DMG and extracting the Ni^{2+} DMG complex in chloroform, and determine its concentration by spectrophotometry.
- (ii) Solvent extraction of zirconium with amberliti LA-1, separation from a mixture of irons and gallium.

III. Ion exchange:

- (i) Determination of exchange capacity of cation exchange resins and anion exchange resins.
- (ii) Separation of metal ions from their binary mixture.
- (iii) Separation of amino acids from organic acids by ion exchange chromatography.

3. pH metric Method:

Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.

4. Photometric Method:

Determination of Na, Ca, Li in cola drinks and fruit juices using fame photometric techniques.

5. Analysis of soil:

- (i) Determination of pH of soil.
- (ii) Total soluble salt
- (iii) Estimation of calcium, magnesium, phosphate, nitrate

Reference Books:

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
2. Willard, H.H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, D.C. Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.
6. Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Edition.
7. Mikes, O. & Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London.
8. Ditts, R.V. Analytical Chemistry: Methods of separation. Van Nostrand, New York, 1974.

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|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Code: CHM 252

COURSE TITLE: INDUSTRIAL CHEMICALS AND ENVIRONMENT

(Credits: 4, Lectures: 5 × 12 = 60)

1. Industrial Gases, Inorganic Chemicals

Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

2. Industrial Metallurgy and Environment and its segments-1

Industrial Metallurgy: Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.

Environment and its segments-1:

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution.

3. Environment and its segments-2

Pollution by SO₂, CO₂, CO, NO_x, H₂S and other foul smelling gases. Methods of estimation of CO, NO_x, SO_x and control procedures.

Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.

4. Environment and its segments-3 :

Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

5. Energy & Environment

Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

References:

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
3. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
4. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.
5. K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.
6. S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.
7. S.E. Manahan, Environmental Chemistry, CRC Press (2005).
8. G.T. Miller, Environmental Science 11th edition. Brooks/ Cole (2006).
9. Mishra, Environmental Studies. Selective and Scientific Books, New Delhi (2005).

COURSE CODE: CHM 252 (LAB)**COURSE TITLE: INDUSTRIAL CHEMICALS & ENVIRONMENT (LAB)****(Credits: 2, Lectures: 60)**

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO₃ and potassium chromate).
6. Estimation of total alkalinity of water samples (CO₃²⁻, HCO₃⁻) using double titration method.
7. Measurement of dissolved CO₂.
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

References:

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
3. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
4. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.
5. K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.
6. S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.

COURSE CODE: CHM 261

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

COURSE TITLE: GREEN CHEMISTRY**(Credits: 4, Lectures: 5 × 12 = 60)****1. Introduction to Green Chemistry**

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry. Green Chemistry in sustainable development. Twelve principles of Green Chemistry with their explanations and examples.

2. Designing a Chemical Synthesis I

Designing a Green Synthesis using the twelve principles; Prevention of Waste/ byproducts, maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation

of atom economy of the rearrangement, addition, substitution and elimination reactions. Prevention/minimization of hazardous/ toxic products reducing toxicity. $\text{risk} = (\text{function}) \text{hazard} \times \text{exposure}$; waste or pollution prevention hierarchy.

Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, solventless processes, immobilized solvents and how to compare greenness of solvents.

3. Designing a Chemical Synthesis II

Designing safer chemicals – different basic approaches to do so; selection of appropriate auxiliary substances (solvents, separation agents), energy requirements for reactions - use of microwaves, ultrasonic energy; selection of starting materials; avoidance of unnecessary derivatization-careful use of blocking/protecting groups; use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; designing of biodegradable products; prevention of chemical accidents; strengthening/development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

4. Green Synthesis I

Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis)

Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction, Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO₂ for precision cleaning and dry cleaning of garments. Ultrasound assisted reactions: sonochemical Simmons-Smith reaction (Ultrasonic alternative to iodine).

5. Green Synthesis II and Future trends in Green Chemistry

Designing of Environmentally safe marine antifoulant. Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments. An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn. Healthier fats and oil by green chemistry, Enzymatic Inter esterification for production of no Trans-Fats and Oils., Development of fully recyclable carpet: Cradle to Cradle carpeting.

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; CO crystal controlled solid state synthesis (C₂S₃); Green chemistry in sustainable development.

References:

1. Ahluwalia, V.K. & Kidwai, M.R. *New Trends in Green Chemistry*, Anamalaya Publishers (2005).
2. Anastas, P.T. & Warner, J.K.: *Green Chemistry - Theory and Practical*, Oxford University Press (1998).
3. Matlack, A.S. *Introduction to Green Chemistry*, Marcel Dekker (2001).
4. Cann, M.C. & Connely, M.E. *Real-World cases in Green Chemistry*, American Chemical Society, Washington (2000).
5. Ryan, M.A. & Tinnesand, M. *Introduction to Green Chemistry*, American Chemical Society, Washington (2002).
6. Lancaster, M. *Green Chemistry: An Introductory Text* RSC Publishing, 2nd Edition, 2010.

COURSE CODE: CHM 261 (LAB)**COURSE TITLE: GREEN CHEMISTRY (LAB)****(Credits: 2, Lectures: 60)****1. Safer starting materials**

Preparation and characterization of nanoparticles of gold using tea leaves.

2. Using renewable resources

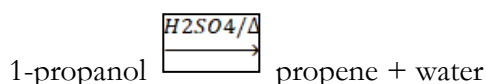
Preparation of biodiesel from vegetable/ waste cooking oil.

3. Avoiding waste

Principle of atom economy.

Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.

Preparation of propene by two methods can be studied

Triethylamine ion + OH⁻ → propene + trimethylpropene + water

Other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.

4. Use of enzymes as catalysts

Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.

5. Alternative Green solventsExtraction of D-limonene from orange peel using liquid CO₂ prepared from dry ice.

Mechanochemical solvent free synthesis of azomethines

6. Alternative sources of energy

Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

References:

1. Anastas, P.T & Warner, J.C. *Green Chemistry: Theory and Practice*, Oxford University Press (1998).
2. Kirchoff, M. & Ryan, M.A. *Greener approaches to undergraduate chemistry experiment*. American Chemical Society, Washington DC (2002).
3. Ryan, M.A. *Introduction to Green Chemistry*, Tinnesand; (Ed), American Chemical Society, Washington DC (2002).
4. Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K. I.K. *Green Chemistry Experiment: A monograph International Publishing House Pvt Ltd. New Delhi*. Bangalore CISBN 978-93- 81141-55-7 (2013).
5. Cann, M.C. & Connelly, M. E. *Real world cases in Green Chemistry*, American Chemical Society (2008).
6. Cann, M. C. & Thomas, P. *Real world cases in Green Chemistry*, American Chemical Society (2008).
7. Lancaster, M. *Green Chemistry: An Introductory Text* RSC Publishing, 2nd Edition, 2010.
8. Pavia, D.L., Lampman, G.M., Kriz, G.S. & Engel, R.G. *Introduction to Organic Laboratory Techniques: A Microscale and Macro Scale Approach*, W.B. Saunders, 1995.

COURSE CODE: CHM 262**COURSE TITLE: SPECTROSCOPIC TECHNIQUES IN CHEMISTRY****(Credits: 4, Lectures: 5 × 12 = 60)**

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

1. UV-Visible Spectroscopy I:

Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument.

Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

2. UV-Visible Spectroscopy II:

Types of electronic transitions, λ_{\max} , Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λ_{\max} for the following systems: α , β unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers.

3. Infrared Spectroscopy:

Infrared spectroscopy: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.

Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

4. Spin Resonance Spectroscopy:

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR (PMR) spectroscopy, Larmor precession, chemical shift and factors influencing it, low resolution spectra, different scales, spin-spin coupling and coupling constant, high resolution spectra. Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple compounds. Applications of IR, UV and NMR for identification of simple organic molecules.

Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

5. Mass spectroscopy:

Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole. Resolution, time and multiple separations, Detection and interpretation (how this is linked to excitation).

References:

1. Banwell, C. N. & McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw-Hill: New Delhi (2006).
2. Kakkar, R. Atomic & Molecular Spectroscopy: Concepts & Applications, Cambridge University Press (2015).
3. Kemp, W. Organic Spectroscopy, Palgrave.
4. Pavia, D. L. et al. Introduction to Spectroscopy 5th Ed. Cengage Learning India Ed. (2015).
5. John R. Dyer: Applications of Absorption Spectroscopy of Organic Compounds, Prentice Hall.
6. R.M. Silverstein, G.C. Bassler & T.C. Morrill: Spectroscopic Identification of Organic Compounds, John Wiley & Sons.

COURSE CODE: CHM 262 (LAB)**COURSE TITLE: SPECTROSCOPIC TECHNIQUES IN CHEMISTRY (LAB)****(Credit: 2, Lectures: 60)**

1. Measurement of 10 Dq by spectrophotometric method
2. Verification of spectrochemical series.
3. Preparation of acetylacetonato complexes of $\text{Cu}^{2+}/\text{Fe}^{3+}$. Find the λ_{max} of the complex.
4. Verify Lambert-Beer's law and determine the concentration of $\text{CuSO}_4/\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ in a solution of unknown concentration
5. Determine the concentrations of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ in a mixture.
6. Determine the amount of iron present in a sample using 1,10-phenanthroline.
7. Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.
8. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided).
9. Determination of pKa values of indicator using spectrophotometry.
10. Structural characterization of compounds by infrared spectroscopy.

References

1. Marr & Rockett Practical Inorganic Chemistry. John Wiley & Sons 1972.
 2. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
 3. Willard, H.H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
 4. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
 5. Harris, D.C. Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.
 6. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.
 7. Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Edition.
 8. Mikes, O. & Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London.
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| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

COURSE CODE: CHM 311

COURSE TITLE: INORGANIC AND ORGANIC CHEMISTRY I

(Credits: 4, Lectures: 5 × 12 = 60)

1. Atomic Structure:

Atomic Structure: Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2 , Schrödinger equation for hydrogen atom. Radial and angular parts of the hydrogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Significance of quantum numbers. Shapes of s, p and d atomic orbitals. Spin quantum number (s) and magnetic spin quantum number (m_s).

Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals. Relative energies of atomic orbitals, Anomalous electronic configurations.

□ Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.

2. Chemical Bonding and Molecular Structure

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Landé equation for calculation of lattice energy (without derivation), Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO⁺. Comparison of VB and MO approaches.

3. Fundamentals of Organic Chemistry

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.

Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values.

Aromaticity: Benzenoids and Hückel's rule.

4. Stereochemistry

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

5. Aliphatic Hydrocarbons

Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.

Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. KMnO_4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymercuration-demercuration, Hydroboration-oxidation.

Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO_4 , ozonolysis and oxidation with hot alk. KMnO_4 .

References:

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
4. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
5. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
6. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
11. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

7. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
8. Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.
9. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
10. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.

COURSE CODE: CHM 311 (LAB)**COURSE TITLE: INORGANIC AND ORGANIC CHEMISTRY I (LAB)****(Credits: 2, Lectures: 60)****Section A: Inorganic Chemistry - Volumetric Analysis**

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO₄.
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO₄.
4. Estimation of Fe (II) ions by titrating it with K₂Cr₂O₇ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using Na₂S₂O₃.

Section B: Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)
2. Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)
 - (a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography
 - (b) Identify and separate the sugars present in the given mixture by paper chromatography.

Reference Books:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

COURSE CODE: CHM 321

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|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

COURSE TITLE: PHYSICAL CHEMISTRY I AND ORGANIC CHEMISTRY II
(Credits: 4, Lectures: 5 × 12 = 60)

1. Chemical Energetics

Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

2. Ionic Equilibria

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

3. Chemical Equilibria And Aromatic Hydrocarbons

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG_0 , Le Chatelier's principle. Relationships between K_p , K_c and K_x for reactions involving ideal gases.

Aromatic hydrocarbons: *Preparation* (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. *Reactions*: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

4. Alkyl And Aryl Halides

Alkyl Halides: Types of Nucleophilic Substitution (S_N1 , S_N2 and S_Ni) reactions, *Preparation*: from alkenes and alcohols. *Reactions*: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Aryl Halides: *Preparation*: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. *Reactions (Chlorobenzene)*: Aromatic nucleophilic substitution (replacement by $-OH$ group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

5. Alcohols, Phenols, Aldehydes And Ketones

Alcohols: *Preparation:* Preparation of 1^o, 2^o and 3^o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. *Reactions:* With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO₄). Oppeneauer oxidation.

Phenols: (Phenol case) *Preparation:* from diazonium salts. *Reactions:* Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Schotten – Baumann Reaction.

Aldehydes and Ketones: (aliphatic and aromatic), *Preparation:* from acid chlorides and from nitriles. *Reactions* – Reaction with HCN, ROH, NaHSO₃, Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff -Kishner reduction. Meerwein-Pondorff -Verley reduction.

Reference Books:

1. T. W. Graham Solomons: *Organic Chemistry, John Wiley and Sons.*
2. Peter Sykes: *A Guide Book to Mechanism in Organic Chemistry*, Orient Longman.
3. I.L. Finar: *Organic Chemistry* (Vol. I & II), E. L. B. S.
4. R. T. Morrison & R. N. Boyd: *Organic Chemistry*, Prentice Hall.
5. Arun Bahl and B. S. Bahl: *Advanced Organic Chemistry*, S. Chand.
6. G. M. Barrow: *Physical Chemistry* Tata McGraw-Hill (2007).
7. G. W. Castellan: *Physical Chemistry* 4th Edn. Narosa (2004).
8. J. C. Kotz, P. M. Treichel & J. R. Townsend: *General Chemistry* Cengage Lening India Pvt. Ltd., New Delhi (2009).
9. B. H. Mahan: *University Chemistry* 3rd Ed. Narosa (1998).

COURSE CODE: CHM 321 (LAB)

COURSE TITLE: PHYSICAL I AND ORGANIC II (LAB)

(Credits: 2, Lectures: 60)

Section A: Physical Chemistry

1. Thermochemistry

1. Determination of heat capacity of calorimeter for different volumes
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO₃, NH₄Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of ΔH .

2. Ionic equilibria

pH measurements: Measurement of pH of different solutions like aerated drinks, fruit juices,

shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.

Section B: Organic Chemistry

Purification of organic compounds by crystallization (from water and alcohol) and distillation.

Criteria of Purity: Determination of melting and boiling points.

Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done. (a) Bromination of Phenol/Aniline, (b) Benzoylation of amines/phenols (c) Oxime and 2,4 dinitrophenylhydrazone of aldehyde/ketone.

Reference Books

A.I. Vogel: Textbook of Practical Organic Chemistry, 5th edition, Prentice-Hall.

F. G. Mann & B. C. Saunders, Practical Organic Chemistry, Orient Longman (1960).

B.D. Khosla, Senior Practical Physical Chemistry, R. Chand & Co.

COURSE CODE: CHM 331

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

COURSE TITLE: PHYSICAL II AND ORGANIC III

(Credits: 4, Lectures: 5 × 12 = 60)

1. Solutions and Phase Equilibria

Ideal solutions and Raoult's law, Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.

Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius-Clapeyron equation, Phase diagram of one-component system (water) and two component systems (lead-silver).

2. Conductance

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations .

3. Electrochemistry

Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Calculation of thermodynamic properties: ΔG , ΔH and ΔS from EMF data. Calculation of equilibrium constant from EMF data. Liquid junction potential and salt bridge. pH determination using hydrogen electrode and quinhydrone electrode. Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).

4. Carboxylic Acids And Amines

Carboxylic acids (aliphatic and aromatic); *Preparation*: Acidic and Alkaline hydrolysis of esters.

Reactions: Hell – Vohlard - Zelinsky Reaction. Preparation of Acid chlorides, Anhydrides, Esters and Amides from acids, Reformatsky Reaction, Perkin condensation.

Amines (Aliphatic and Aromatic); *Preparation*: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2 , Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

5. Amino Acids and Carbohydrates

Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis. *Reactions of Amino acids*: ester of $-\text{COOH}$ group, acetylation of $-\text{NH}_2$ group, complexation with Cu^{2+} ions. Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C-terminal (thiohydantoin). Synthesis of simple peptides by N-protection (t-butyloxycarbonyl) & C-activating groups.

Carbohydrates: Classification, Glucose and Fructose (open chain and cyclic structure), Absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disaccharides (sucrose, cellobiose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

References:

1. G. M. Barrow: *Physical Chemistry* Tata McGraw-Hill (2007).
2. G. W. Castellan: *Physical Chemistry* 4th Ed. Narosa (2004).
3. J. C. Kotz, P. M. Treichel, J. R. Townsend, *General Chemistry*, Cengage Learning
4. India Pvt. Ltd.: New Delhi (2009).
5. B. H. Mahan: *University Chemistry*, 3rd Edn. Narosa (1998).
6. R. H. Petrucci, *General Chemistry*, 5th Edn., Macmillan Publishing Co.: New York (1985).
7. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

COURSE CODE: CHM 331 (LAB)

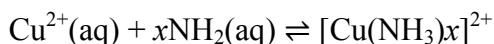
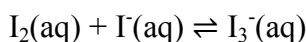
COURSE TITLE: PHYSICAL II AND ORGANIC III (LAB)

(Credits: 2, Lectures: 60)

Section A: Physical Chemistry

1. Distribution

Study of the equilibrium of one of the following reactions by the distribution method:



2. Phase equilibria

Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.

Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.

Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature.

Section B: Organic Chemistry

- a. Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.
- b. Separation of amino acids by paper chromatography
- c. Determination of the concentration of glycine solution by formylation method.
- d. Titration curve of glycine
- e. Action of salivary amylase on starch
- f. Effect of temperature on the action of salivary amylase on starch.
- g. Determination of the saponification value of an oil/fat.
- h. Determination of the iodine value of an oil/fat
- i. Differentiation between a reducing/non-reducing sugar.

Reference Books:

- A.I. Vogel: Textbook of Practical Organic Chemistry, Prentice Hall, 5th Edn.
F. G. Mann & B. C. Saunders: Practical Organic Chemistry, Orient Longman, 1960.
B.D. Khosla: Senior Practical Physical Chemistry, R. Chand & Co.
Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry*, Universities Press.

COURSE CODE: CHM 341

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

COURSE TITLE: INORGANIC CHEMISTRY-II**(Credits: 4, Lectures: 5 × 12 = 60)**

1. General Principles of Metallurgy

General Principles of Metallurgy: Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy. Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkel-de Boer process and Mond's process, Zone refining. (12 Lectures)

2. Acids and Bases:

Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle.

3. Chemistry of s and p Block Elements I:

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of s block elements.

Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate.

4. Chemistry of s and p Block Elements II:

Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses: Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens.

Noble gases and Inorganic Polymers:

Noble Gases. Occurrence and uses, Rationalization of inertness of noble gases, Clathrates; Preparation, properties, structure (VSEPR) and bonding (VBT) of XeF₂, XeF₄ and XeF₆.

Inorganic Polymers. Types of inorganic polymers and comparison with organic polymers. Synthesis, Structural features, classification and applications of silicates, silicones and phosphazenes.

Reference Books:

1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
2. Douglas, B.E; Mc Daniel, D.H. & Alexander, J.J. Concepts & Models of Inorganic Chemistry 3rd Ed., John Wiley Sons, N.Y. 1994.
3. Greenwood, N.N. & Earnshaw. Chemistry of the Elements, ButterworthHeinemann. 1997.
4. Cotton, F.A. & Wilkinson, G. Advanced Inorganic Chemistry, Wiley, VCH, 1999.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.
6. Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry 4th Ed., Pearson, 2010.
7. Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).

COURSE CODE: CHM 341 (LAB)**COURSE TITLE: INORGANIC CHEMISTRY II (LAB)****(Credits: 2, Lectures: 60)**

1. Iodometric estimation of potassium dichromate and copper sulphate
2. Iodimetric estimation of antimony in tartaremetic
3. Estimation of amount of available chlorine in bleaching powder and household bleaches
4. Estimation of iodine in iodized salts.
5. Iodimetric estimation of ascorbic acid in fruit juices.
6. Estimation of dissolved oxygen in water samples.
7. Gravimetric estimation of sulphate as barium sulphate.
8. Gravimetric estimation of aluminium as oximato complex
9. Preparation of the following: potash alum, chrome alum, tetraamminecopper(II) sulphate monohydrate, potassium trioxalato ferrate(III) (any two, including one double salt and one complex).

References:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

SKILL ENHANCEMENT COURSE (SEC)**COURSE CODE: CHM 531**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

COURSE TITLE: LITERATURE SURVEY**(Credits: 02, Lectures: 30)**

Print: Sources of information: Primary, secondary, tertiary sources; Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.

Digital: Web resources, E-journals, Journal access, TOC alerts, Hot articles, Citation index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, Preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki- Databases, ChemSpider, Science Direct, SciFinder, Scopus.

Information Technology and Library Resources: The Internet and World Wide Web. Internet resources for chemistry. Finding and citing published information.

References:

1. Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J. & Jones, A. (2011) Practical skills in chemistry. 2nd Ed. Prentice-Hall, Harlow.
2. Hibbert, D. B. & Gooding, J. J. (2006) Data analysis for chemistry. Oxford University Press.
3. Topping, J. (1984) Errors of observation and their treatment. Fourth Ed., Chapman Hall, London.
4. Harris, D. C. Quantitative chemical analysis. 6th Ed., Freeman (2007) Chapters 3-5.
5. Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis. Cambridge Univ. Press (2001) 487 pages.
6. Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.
7. OSU safety manual 1.01.

COURSE CODE: 531

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

COURSE TITLE: PHARMACEUTICAL CHEMISTRY**(CREDITS: 02, LECTURES: 30)****Drugs & Pharmaceuticals**

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, antiinflammatory agents (Aspirin, paracetamol, Ibuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

Fermentation

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

Practicals

1. Preparation of Aspirin and its analysis.
2. Preparation of magnesium bisilicate (Antacid).

References:

1. Patrick, G. L. Introduction to Medicinal Chemistry, Oxford University Press, UK, 2013.
2. Singh, H. & Kapoor, V.K. Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi, 2012.
3. Foye, W.O., Lemke, T.L. & William, D.A.: Principles of Medicinal Chemistry, 4th ed., B.I. Waverly Pvt. Ltd. New Delhi

COURSE CODE: CHM 541

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

COURSE TITLE: WRITING SCIENTIFIC PAPERS**(Credits: 02, Lectures: 30)**

Reporting practical and project work. Writing literature surveys and reviews. Organizing a poster display. Giving an oral presentation.

Writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work. Writing ethics. Avoiding plagiarism.

References:

1. Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J. & Jones, A. (2011) Practical skills in chemistry. 2nd Ed. Prentice-Hall, Harlow.
2. Hibbert, D. B. & Gooding, J. J. (2006) Data analysis for chemistry. Oxford University Press.
3. Topping, J. (1984) Errors of observation and their treatment. Fourth Ed., Chapman Hall, London.
4. Harris, D. C. Quantitative chemical analysis. 6th Ed., Freeman (2007) Chapters 3-5.
5. Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis. Cambridge Univ. Press (2001) 487 pages.
6. Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.
7. OSU safety manual 1.01.

COURSE CODE: CHM 541

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

COURSE TITLE: PROJECT**(Credits: 02)**

A student has to select and carry out a project on analysis of water, soil, food adulteration, food quality, impurities in chemicals, quality of detergents, preparation of chalks, soaps, paints etc. which are based on application of basic chemistry practical. Such a project is to be carried out applying research methodology for chemistry, written using methods of scientific writing, and submitted with proper referencing and presented to the department.

GEOLOGY HONOURS

| Semester | Core course | Ability Enhancement Course | Skill Enhancement Course | Discipline Specific Elective Course | Generic Elective Course |
|-------------------------|--|----------------------------|--|-------------------------------------|-------------------------|
| I | Earth System Science | English Communication | | | Essentials of Geology |
| | Mineral Science | | | | |
| II | Elements of Geochemistry | Environmental Studies | | | Rocks and Minerals |
| | Structural Geology | | | | |
| III | Igneous Petrology | | Field Geology – I (Basic Field Training) | | Earth Resources |
| | Sedimentary Petrology | | | | |
| | Paleontology | | | | |
| IV | Metamorphic Petrology | | Field Geology – II (Geological mapping) | | Earth Surface Processes |
| | Stratigraphic Principles and Indian Stratigraphy | | | | |
| | Hydrogeology | | | | |
| V | Economic Geology | | | Exploration Geology | |
| | Geomorphology | | | Earth and Climate | |
| VI | Engineering Geology | | | Fuel Geology | |
| | Remote Sensing and GIS | | | Urban Geology | |
| No. of Courses (Credit) | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |

I. CORE COURSE

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Code: GEO 111**Course Title: EARTH SYSTEM SCIENCE****THEORY****LECTURES:****Unit 1: Earth as a planet**

Holistic understanding of dynamic planet 'Earth' through Astronomy, Geology, Meteorology and Oceanography.

Introduction to various branches of Earth Sciences.

General characteristics and origin of the Universe, Solar System and its planets. The terrestrial and jovian planets.

Meteorites and Asteroids

Earth in the solar system - origin, size, shape, mass, density, rotational and revolution parameters and its age.

Cosmic abundance of elements

Distribution of elements in solar system and in Earth

Unit 2: Earth's magnetic field

Earth's magnetic field

Formation of core, mantle, crust, hydrosphere, atmosphere and biosphere

Convection in Earth's core and production of its magnetic field

Mechanical layering of the Earth.

Unit 3: Plate Tectonics Concept of plate tectonics, sea-floor spreading and continental drift

Geodynamic elements of Earth- Mid Oceanic Ridges, trenches, transform faults and island arcs

Origin of oceans, continents, mountains and rift valleys

Earthquake and earthquake belts

Volcanoes- types, products and their distribution.

Unit 4: Hydrosphere and Atmosphere

Oceanic current system and effect of Coriolis force

Concepts of eustasy Land-air-sea interaction

Wave erosion and beach processes

Atmospheric circulation

Weather and climatic changes

Earth's heat budget.

Unit 5: Understanding the past from stratigraphic records

Nature of stratigraphic records

Standard stratigraphic time scale and introduction to the concept of time in geological studies

Introduction to geochronological methods and their application in geological studies

History of development in concepts of uniformitarianism, catastrophism and neptunism

PRACTICALS:**Course Code: GEO(L) 111****Course Title: Lab: EARTH SYSTEM SCIENCE**

1. Study of major geomorphic features and their relationships with outcrops through physiographic models. Detailed
2. Study of topographic sheets and preparation of physiographic description of an area
3. Study of soil profile of any specific area

4. Study of distribution of major lithostratigraphic units on the map of India
5. Study of distribution of major dams on map of India and their impact on river systems
6. Study of major ocean currents of the World
7. Study of seismic profile of a specific area and its interpretation

SUGGESTED READINGS:

1. Duff, P. M. D., & Duff, D. (Eds.). (1993). Holmes' principles of physical geology. Taylor & Francis.
2. Emiliani, C. (1992). Planet earth: cosmology, geology, and the evolution of life and environment. Cambridge University Press.
3. Gross, M. G. (1977). Oceanography: A view of the earth.

Course Code: GEO 112
Course Title: MINERAL SCIENCE

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

Unit 1: Crystallography

Elementary ideas about crystal morphology in relation to internal structures

Crystal parameters and indices

Crystal symmetry and classification of crystals into six systems and 32 point groups

Unit 2: Crystal symmetry and projections

Elements of crystal chemistry and aspects of crystal structures

Stereographic projections of symmetry elements and forms

Unit 3: Rock forming minerals

Minerals - definition and classification, physical and chemical properties

Composition of common rock-forming minerals

Silicate and non-silicate structures; CCP and HCP structures

Unit 4: Properties of light and optical microscopy

Nature of light: Refraction, reflection, polarization and interference of light; and principles of optical mineralogy: Pleochroism, twinning, extinction, isotropism, anisotropism

Unit 5:

Introduction to the petrological microscope and identification of common rock-forming minerals: Quartz, feldspars, micas, olivine, pyroxene and amphiboles.

PRACTICALS:

Course Code: GEO(L) 112
Course Title: Lab: MINERAL SCIENCE

PRACTICALS:

Observation and documentation on symmetry of crystals

Study of physical properties of minerals in hand specimen Silicates: Olivine, Garnet, Andalusite, Sillimanite, Kyanite, Staurolite, Beryl, Tourmaline, Augite, Actinolite, Tremolite, Hornblende, Serpentine, Talc, Muscovite, Biotite, Phlogopite, Quartz, Orthoclase, Plagioclase, Microcline, Nepheline, Sodalite, Zeolite Quartz varieties: Chert, Flint, Chalcedony, Agate, Jasper, Amethyst, Rose quartz, Smoky quartz, Rock crystal. Native Metals/non-metals, Sulfides, Oxides- Copper, Sulfur, Graphite, Pyrite, Corundum, Magnetite Hydroxides, Halides, Carbonates, Sulfates, Phosphates: Psilomelane, Fluorite, Calcite, Malachite, Gypsum, Apatite. Study of some key silicate minerals under optical microscope and their characteristic properties.

SUGGESTED READINGS:

1. Klein, C., Dutrow, B., Dwight, J., & Klein, C. (2007). The 23rd Edition of the Manual of Mineral Science (after James D. Dana). J. Wiley & Sons.
2. Kerr, P. F. (1959). Optical Mineralogy. McGraw-Hill.
3. Verma, P. K. (2010). Optical Mineralogy (Four Colour). Ane Books Pvt Ltd.
4. Deer, W. A., Howie, R. A., & Zussman, J. (1992). An introduction to the rock-forming minerals (Vol. 696). London: Longman.

Course Code: GEO 121
Course Title: ELEMENTS OF GEOCHEMISTRY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY**Unit 1:** Concepts of geochemistry

Introduction to properties of elements: The periodic table
 Chemical bonding, states of matter and atomic environment of elements
 Geochemical classification of elements

Unit 2: Layered structure of Earth and geochemistry

Composition of different Earth reservoirs and the nuclides and radioactivity
 Conservation of mass, isotopic and elemental fractionation
 Concept of radiogenic isotopes in geochronology and isotopic tracers

Unit 3: Element transport

Advection and diffusion
 Chromatography Aqueous geochemistry- basic concepts and speciation in solutions, Eh, pH relations
 Elements of marine chemistry
 Mineral reactions- diagenesis and hydrothermal reactions.

Unit 4: Geochemistry of solid Earth

The solid Earth – geochemical variability of magma and its products.
 The Earth in the solar system, the formation of solar system
 Composition of the bulk silicate Earth
 Meteorites

Unit 5: Geochemical behavior of selected elements like Si, Al, K, Na etc.**PRACTICALS:**

Course Code: GEO(L) 121
Course Title: Lab: ELEMENTS OF GEOCHEMISTRY

Types of geochemical data analysis and interpretation; of common geochemical plots.
 Geochemical analysis of geological materials.
 Geochemical variation diagrams and its interpretations.

SUGGESTED READINGS:

1. Mason, B. (1986) Principles of Geochemistry. 3rd Edition, Wiley New York.
2. Rollinson, H. (2007) Using geochemical data – evaluation, presentation and interpretation. 2nd Edition. Publisher Longman Scientific & Technical.

3. Walther, J. V. (2009). Essentials of geochemistry. Jones & Bartlett Publishers.
4. Albarède, F. (2003). Geochemistry: an introduction. Cambridge University Press.
5. Faure, Gunter and Teresa M. Mensing (2004). Isotopes: Principles and Applications, Wiley India Pvt. Ltd

Course Code: GEO 122
Course Title: STRUCTURAL GEOLOGY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Unit 1: Structure and Topography

Effects of topography on structural features, Topographic and structural maps; Important representative factors of the map

Unit 2: Stress and strain in rocks

Concept of rock deformation: Stress and Strain in rocks, Strain ellipses of different types and their geological significance.

Planar and linear structures; Concept of dip and strike; Outcrop patterns of different structures.

Unit 3: Folds

Fold morphology; Geometric and genetic classification of folds; Introduction to the mechanics and types of folding: Buckling, Bending, Flexural slip and flow folding.

Unit 4: Foliation and lineation

Description and origin of foliations: axial plane cleavage and its tectonic significance
 Description and origin of lineation and relationship with the major structures

Unit 5: Fractures and faults

Geometric and genetic classification of fractures and faults
 Effects of faulting on the outcrops
 Geologic/geomorphic criteria for recognition of faults and fault plane.

PRACTICALS:

Course Code: GEO(L) 122
Course Title: Lab: STRUCTURAL GEOLOGY

Basic idea of topographic contours, Topographic sheets of various scales.
 Introduction to Geological maps: Lithological and Structural maps
 Structural contouring and 3-point problems of dip and strike
 Drawing profile sections and interpretation of geological maps of different complexities
 Exercises of stereographic projections of mesoscopic structural data (planar, linear, folded etc.)

SUGGESTED READINGS:

1. Davis, G. R. (1984) Structural Geology of Rocks and Region. John Wiley
2. Billings, M. P. (1987) Structural Geology, 4th edition, Prentice-Hall.
3. Park, R. G. (2004) Foundations of Structural Geology. Chapman & Hall.
4. Pollard, D. D. (2005) Fundamental of Structural Geology. Cambridge University Press.
5. Ragan, D. M. (2009) Structural Geology: an introduction to geometrical techniques (4th Ed). Cambridge University Press (For Practical)
6. Lahee F. H. (1962) Field Geology. McGraw Hill

Course Code: GEO 131
Course Title: IGNEOUS GEOLOGY

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY LECTURES:

Unit 1: Concepts of Igneous petrology
 Introduction to petrology: Heat flow, geothermal gradients through time, origin and nature of magma.

Unit 2: Forms Classification of igneous rocks
 Textures and structures of igneous rocks
 Mode of occurrence of Igneous rocks

Unit 3: Phase diagrams and petrogenesis
 Binary and Ternary Phase diagrams in understanding crystal-melt equilibrium in basaltic and granitic magmas
 Magma generation in crust and mantle, their emplacement and evolution

Unit 4: Magmatism in different tectonic settings
 Magmatism in the oceanic domains (MORB, OIB) Magmatism along the plate margins (Island arcs/ continental arcs)

Unit 5: Petrogenesis of Igneous rocks
 Petrogenesis of Felsic and Mafic igneous rocks
 Komatiites, Granitoides, Basalt, Gabbros
 Alkaline rocks, kimberlites and lamproites.

PRACTICALS:

Course Code: GEO(L) 131
Course Title: Lab: IGNEOUS GEOLOGY

Study of important igneous rocks in hand specimens and thin sections- granite, granodiorite, diorite, gabbro, anorthosites, ultramafic rocks, basalts, andesites, trachyte, rhyolite, dacite.

SUGGESTED READINGS:

1. Philpotts, A., & Ague, J. (2009). Principles of igneous and metamorphic petrology. Cambridge University Press.
2. Winter, J. D. (2014). Principles of igneous and metamorphic petrology. Pearson.
3. Rollinson, H. R. (2014). Using geochemical data: evaluation, presentation, interpretation. Routledge.
4. Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks. McGraw-Hill Science Engineering.
5. McBirney, A. R. (1984). Igneous Petrology. San Francisco (Freeman, Cooper & Company) and Oxford (Oxford Univ. Press),
6. Myron G. Best (2001). Igneous and Metamorphic Petrology,
7. K. G. Cox, J. D. Bell. (1979). The Interpretation of Igneous Rocks. Springer/Chapman & Hall.
8. Bose M.K. (1997). Igneous Petrology.
9. G W Tyrrell. (1926). Principles of Petrology. Springer

Course Code: GEO 132
Course Title: SEDIMENTARY GEOLOGY

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY LECTURES:

Unit 1: Origin of sediments

Weathering and sedimentary flux: Physical and chemical weathering, soils and paleosols.

Unit 2: Sediment granulometry

Grain size scale, particle size distribution, Environmental connotation; particle shape and fabric

Unit 3: Sedimentary structures and environment

Fluid flow and sediment transport: Types of fluids, Laminar vs. turbulent flow,

Sedimentary structure- Primary and syn-sedimentary structures

Paleocurrent analysis- Paleocurrents for different sedimentary environments

Unit 4: Varieties of sedimentary rocks

Siliciclastic rocks: Conglomerates, sandstones, mudrocks.

Carbonate rocks, controls of carbonate deposition, components and classification of limestone, dolomite and dolomitisation

Unit 5: Diagenesis: Concepts of diagenesis, Stages of diagenesis, Compaction and cementation.

PRACTICALS:

Course Code: GEO(L) 132

Course Title: Lab: SEDIMENTARY GEOLOGY

Exercises on sedimentary structures

Particle size distribution and statistical treatment

Paleocurrent analysis

Petrography of clastic and non-clastic rocks through hand specimens and thin sections

SUGGESTED READINGS:

1. Prothero, D. R., & Schwab, F. (2004). Sedimentary geology. Macmillan.
2. Tucker, M. E. (2006) Sedimentary Petrology, Blackwell Publishing.
3. Collinson, J. D. & Thompson, D. B. (1988) Sedimentary structures, Unwin- Hyman, London.
4. Nichols, G. (2009) Sedimentology and Stratigraphy Second Edition. Wiley Blackwell

Course Code: GEO 133
Course Title: PALEONTOLOGY

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY
LECTURES:

Unit 1: Fossilization and fossil record

Nature and importance of fossil record; Fossilization processes and modes of preservation

Taxonomy and Species concept

Species concept with special reference to paleontology, Taxonomic hierarchy Theory of organic evolution interpreted from fossil record

Unit 2: Invertebrates

Brief introduction to important invertebrate groups (Bivalvia, Gastropoda, Brachiopoda) and their biostratigraphic significance

Significance of ammonites in Mesozoic biostratigraphy and their paleobiogeographic implications

Functional adaptation in trilobites and ammonoids.

Unit 3: Vertebrates

Origin of vertebrates and major steps in vertebrate evolution.

Mesozoic reptiles with special reference to origin diversity and extinction of dinosaurs

Evolution of horse and intercontinental migrations.

Human evolution.

Unit 4. Introduction to Paleobotany, Gondwana Flora

Introduction to Ichnology.

Unit 5: Application of fossils in Stratigraphy

Biozones, index fossils, correlation

Role of fossils in sequence stratigraphy

Fossils and paleoenvironmental analysis

Fossils and paleobiogeography, biogeographic provinces, dispersals and barriers

Paleoecology – fossils as a window to the evolution of ecosystems

-

PRACTICALS:

Course Code: GEO(L) 133

Course Title: Lab: PALEONTOLOGY

Study of fossils showing various modes of preservation

Study of diagnostic morphological characters, systematic position, stratigraphic position and age of various invertebrate, vertebrate and plant fossils

SUGGESTED READINGS:

1. Raup, D. M., Stanley, S. M., Freeman, W. H. (1971) Principles of Paleontology
2. Clarkson, E. N. K. (2012) Invertebrate paleontology and evolution 4th Edition by Blackwell Publishing.
3. Benton, M. (2009). Vertebrate paleontology. John Wiley & Sons.
4. Shukla, A. C., & Misra, S. P. (1975). Essentials of paleobotany. Vikas Publisher

Course Code: GEO 141
Course Title: METAMORPHIC PETROLOGY

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY LECTURES:

Unit 1: Metamorphism: controls and types.

Definition of metamorphism. Factors controlling metamorphism

Types of metamorphism - contact, regional, fault zone metamorphism, impact metamorphism.

Unit 2: Metamorphic facies and grades

Index minerals, Chemographic projections

Metamorphic zones and isograds.

Concept of metamorphic facies and grade

Mineralogical phase rule of closed and open system

Structure and textures of metamorphic rocks

Unit 3: Metamorphism and Tectonism Relationship between metamorphism and deformation

Metamorphic mineral reactions (prograde and retrograde)

Unit 4: Migmatites, structures and their origin

Metasomatism and its types and role of fluids in metamorphism

Unit 5: Metamorphic rock associations- schists, gneisses, khondalites, charnockites, blue schists and eclogites

PRACTICALS:

Course Code: GEO(L) 141
Course Title: Lab: METAMORPHIC PETROLOGY

Megascopic and microscopic study (textural and mineralogical) of the following metamorphic rocks:

Low grade metamorphic rocks: serpentinites, albite-epidote-chlorite, quartz schist, slate, talc-tremolite calcite-quartz schist.

Medium to high grade metamorphic rocks: Gneisses, amphibolite, hornfels, garnetiferous schists, sillimanite-kyanite-bearing rocks, Granulites, eclogite, diopside-forsterite marble.

Laboratory exercises in graphic plots for petrochemistry and interpretation of assemblages.

SUGGESTED READINGS:

1. Philpotts, A., & Ague, J. (2009). Principles of igneous and metamorphic petrology. Cambridge University Press.
2. Winter, J. D. (2014). Principles of igneous and metamorphic petrology. Pearson.
3. Rollinson, H. R. (2014). Using geochemical data: evaluation, presentation, interpretation. Routledge.
4. Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks. McGraw-Hill Science Engineering.
5. Yardley, B. W., & Yardley, B. W. D. (1989). An introduction to metamorphic petrology. Longman Earth Science Series.

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| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Code: GEO 142

Course Title: STRATIGRAPHIC PRINCIPLES AND INDIAN STRATIGRAPHY

THEORY LECTURES:

Unit 1: Principles of stratigraphy

Fundamentals of litho-, bio- and chrono-stratigraphy

Introduction to concepts of dynamic stratigraphy (chemostratigraphy, seismic stratigraphy, sequence stratigraphy)

Code of stratigraphic nomenclature

International Stratigraphic Code – development of a standardized stratigraphic nomenclature.

Concepts of Stratotypes. Global Stratotype Section and Point (GSSP).

Sequence stratigraphy and their subdivisions with Indian examples.

Facies concept in stratigraphy.

Concept of paleogeographic reconstruction

Unit 2: Physiographic and tectonic subdivisions of India

Brief introduction to the physiographic and tectonic subdivisions of India.

Introduction to Indian Shield

Introduction to Proterozoic basins of India.

Geology of Vindhyan and Cudappah basins of India

Unit 3: Phanerozoic Stratigraphy of India- I

Paleozoic Succession of Kashmir and its correlatives from Spiti Stratigraphy

Structure and hydrocarbon potential of Gondwana basins.

Mesozoic stratigraphy of India:

a. Triassic successions of Spiti,

b. Jurassic of Kutch,

c. Cretaceous, successions of Cauvery basins

Cenozoic stratigraphy of India:

a. Siwalik successions,

b. Assam, Andaman and Arakan basins.

Unit 4: Phanerozoic Stratigraphy of India -II

Stratigraphy and structure of Krishna-Godavari basin, Bombay offshore basin, Kutch and Saurashtra basins and their potential for hydrocarbon exploration. Volcanic provinces of India: Deccan,

Rajmahal, Sylhet Trap.

Unit 5: Stratigraphic boundaries

Important Stratigraphic boundaries in India - a. Precambrian-Cambrian boundary, b. Permian-Triassic boundary, and c.

Cretaceous-Tertiary boundary.

PRACTICALS: -

Course Code: GEO(L) 142

Course Title: Lab: STRATIGRAPHIC PRINCIPLES AND INDIAN STRATIGRAPHY

1. Study of geological map of India and identification of major stratigraphic units.

2. Study of rocks in hand specimens from known Indian stratigraphic horizons

3. Drawing various paleogeographic maps of Precambrian time

4. Study of different Proterozoic supercontinent reconstructions.

SUGGESTED READINGS:

1. Krishnan, M. S. (1982) Geology of India and Burma, CBS Publishers, Delhi

2. Doyle, P. & Bennett, M. R. (1996) Unlocking the Stratigraphic Record. John Wiley

3. Ramakrishnan, M. & Vaidyanadhan, R. (2008) Geology of India Volumes 1 & 2, Geological society of India, Bangalore.

4. Valdiya, K. S. (2010) The making of India, Macmillan India Pvt. Ltd.

Course Code: GEO 143
Course Title: HYDROGEOLOGY

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

LECTURES:

Unit 1: Introduction and basic concepts

Scope of hydrogeology and its societal relevance

Hydrologic cycle: precipitation, evapo-transpiration, run-off, infiltration and subsurface movement of water.

Rock properties affecting groundwater, Vertical distribution of subsurface water

Types of aquifer, aquifer parameters, anisotropy and heterogeneity of aquifers

Unit 2: Groundwater flow

Darcy's law and its validity

Intrinsic permeability and hydraulic conductivity

Groundwater flow rates and flow direction

Laminar and turbulent groundwater flow

Unit 3: Well hydraulics and Groundwater exploration

Basic Concepts (drawdown; specific capacity etc)

Elementary concepts related to equilibrium and non-equilibrium conditions for water flow to a well in confined and unconfined aquifers.

Surface-based groundwater exploration methods

Introduction to subsurface borehole logging methods

Unit 4: Groundwater chemistry

Physical and chemical properties of water and water quality

Introduction to methods of interpreting groundwater quality data using standard graphical plots

Sea water intrusion in coastal aquifers

Unit 5: Groundwater management

Surface and subsurface water interaction

Groundwater level fluctuations

Basic concepts of water balance studies, issues related to groundwater resources development and management

Rainwater harvesting and artificial recharge of groundwater

PRACTICALS:

Course Code: GEO(L) 143

Course Title: Lab: HYDROGEOLOGY

Preparation and interpretation of water level contour maps and depth to water level maps

Study, preparation and analysis of hydrographs for differing groundwater conditions

Water potential zones of India (map study).

Graphical representation of chemical quality data and water classification (C-S and Trilinear diagrams) Simple numerical problems related to: determination of permeability in field and laboratory, Groundwater flow, Well hydraulics etc.

SUGGESTED READINGS:

1. Todd, D. K. 2006. Groundwater hydrology, 2nd Ed., John Wiley & Sons, N.Y.

2. Davis, S. N. and De Weist, R.J.M. 1966. Hydrogeology, John Wiley & Sons Inc., N.Y.

3. Karanth K.R., 1987, Groundwater: Assessment, Development and management, Tata McGrawHill Pub. Co. Ltd.

Course Code: GEO 151
Course Title: ECONOMIC GEOLOGY

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

LECTURES:

Unit 1 Ores and gangues

Ores, gangue minerals, tenor, grade and lodes
 Resources and reserves- Economic and Academic definitions
 Ore grade and Reserve, assessment of grade, reserve estimation

Unit 2: Mineral deposits and Classical concepts of Ore formation

Mineral occurrence, Mineral deposit and Ore deposit
 Historical concepts of ore genesis: Man's earliest vocation- Mining
 Plutonist and Neptunist concepts of ore genesis

Unit 3: Mineral exploration

Exploration and exploitation techniques
 Remote Sensing, Geophysical and Geochemical Explorations
 Drilling- types, borehole logs and transverse sections

Unit 4: Structure and modern concept of ore genesis

Concordant and discordant ore bodies
 Endogenous processes: Magmatic concentration, skarns, greisens, and hydrothermal deposits
 Exogenous processes: weathering products and residual deposits, oxidation and supergene enrichment, placer deposits.

Unit 5: Metallic and Nonmetallic ores

Metallogenic provinces and epochs
 Important ferrous and non-ferrous deposits of India including atomic minerals
 Non-metallic and industrial rocks and minerals in India.
 Introduction to gemstones.

PRACTICALS:

Course Code: GEO(L) 151
Course Title: Lab: ECONOMIC GEOLOGY

Megascope identification
 Study of microscopic properties of ore forming minerals (Oxides and sulphides).
 Preparation of maps: Distribution of important ores and other economic minerals in India.

SUGGESTED READINGS:

1. Guilbert, J.M. and Park Jr., C.F. (1986) The Geology of Ore deposits. Freeman & Co.
2. Bateman, A.M. and Jensen, M.L. (1990) Economic Mineral Deposits. John Wiley.
3. Evans, A.M. (1993) Ore Geology and Industrial minerals. Wiley
4. Laurence Robb. (2005) Introduction to ore forming processes. Wiley.
5. Gokhale, K.V.G.K. and Rao, T.C. (1978) Ore deposits of India their distribution and processing, Tata-McGraw Hill, New Delhi.
6. Deb, S. (1980) Industrial minerals and rocks of India. Allied Publishers.
7. Sarkar, S.C. and Gupta, A. (2014) Crustal Evolution and Metallogeny in India. Cambridge Publications.

Course Code: GEO 152
Course Title: GEOMORPHOLOGY

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

LECTURES:

Unit 1: Introduction to Geomorphology: Historical development of geomorphological concepts and Scales in geomorphology, Endogenic and Exogenic processes

Unit 2: Geoid, Topography, Hypsometry, Global Hypsometry, Major Morphological features Large Scale Topography - Ocean basins, Plate tectonics overview, Large scale mountain ranges (with emphasis on Himalaya).

Unit 3: Surficial Processes and geomorphology, Weathering and associated landforms, Hill slopes Glacial, Periglacial processes and landforms, Fluvial processes and landforms, Aeolian Processes and landforms, Coastal Processes and landforms, Landforms associated with igneous activities

Unit 4: Endogenic- Exogenic interactions, Rates of uplift and denudation, Tectonics and drainage development, Sea-level change, Long-term landscape development

Unit 5: Surface processes and natural hazards. Overview of Indian Geomorphology, Extraterrestrial landforms

PRACTICALS:

Course Code: GEO(L) 152
Course Title: Lab: GEOMORPHOLOGY

Reading topographic maps ,Concept of scale Preparation of a topographic profile , Preparation of longitudinal profile of a river; Preparing Hack Profile; Calculating Stream length gradient index, Morphometry of a drainage basin, Calculating different morphometric parameters , Preparation of geomorphic map , Interpretation of geomorphic processes from the geomorphology of the area.

SUGGESTED READINGS:

1. Robert S. Anderson and Suzzane P. Anderson (2010): Geomorphology - The Mechanics and Chemistry of Landscapes. Cambridge University Press.
2. M.A. Summerfield (1991) Global Geomorphology. Wiley & Sons.

Course Code: GEO 161
Course Title: ENGINEERING GEOLOGY

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY LECTURES:

Unit 1: Geology vs. Engineering,
 Role of Engineering geologists in planning, design and construction of major man-made structural features
 Site investigation and characterization
 Foundation treatment; Grouting, Rock Bolting and other support mechanisms

Unit 2: Intact Rock and Rock Mass properties
 Rock aggregates; Significance as Construction Material
 Concept, Mechanism and Significance of Rock Quality Designation (RQD)
 Concept, Mechanism and Significance of:
 a. Rock Structure Rating (RSR)
 b. Rock Mass Rating (RMR)
 c. Tunneling Quality Index (Q)

Unit 3: Geological, Geotechnical and Environmental considerations for Dams and Reservoirs
 Tunnels and Tunneling Methods

Unit 4: Landslides; Causes, Factors and corrective/Preventive measures
 Earthquakes; Causes, Factors and corrective/Preventive measures

Unit 5: Case histories related to Indian Civil Engineering Projects: Dams, tunnels, highways and rail-ways.

PRACTICALS:

Course Code: GEO(L) 161
Course Title: Lab: ENGINEERING GEOLOGY

1. Computation of reservoir area, catchment area, reservoir capacity and reservoir life.
2. Merits, demerits & remedial measures based upon geological cross sections of project sites.
3. Computation of Index properties of rocks
4. Computation of RQD, RSR, RMR and 'Q'
5. Studies of engineering properties of rocks in hand specimens.

SUGGESTED READINGS:

1. Krynin, D.P. and Judd W.R. 1957. Principles of Engineering Geology and Geotechnique, McGraw Hill (CBS Publ).
2. Johnson, R.B. and De Graf, J.V. 1988. Principles of Engineering Geology, John Wiley.
3. Goodman, R.E., 1993. Engineering Geology: Rock in Engineering constructions. John Wiley & Sons, N.Y.
4. Waltham, T., 2009. Foundations of Engineering Geology (3rd Edn.) Taylor & Francis.
5. Bell: F.G-, 2006. Basic Environmental and Engineering Geology Whittles Publishing.
6. Bell, .F.G, 2007. Engineering Geology, Butterworth-Heineman

Course Code: GEO 162
Course Title: REMOTE SENSING AND GIS

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY LECTURES:

Unit 1: Photogeology

Types and acquisition of aerial photographs; Scale and resolution; Principles of stereoscopy, relief displacement, vertical exaggeration and distortion
 Elements of air photo interpretation
 Identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms

Unit 2: Remote Sensing, Concepts in Remote Sensing and EM radiations and its interaction with atmosphere

Platforms, Sensors and scanners
 Satellites and their characteristics
 Data formats- Raster and Vector
 Introduction to microwave remote sensing and its applications.

Unit 3: Digital Image Processing, Image Errors, Rectification and Restoration, FCC, Image Enhancement, Filtering, Image Rationing, Image classification – Supervised and unsupervised classification; accuracy assessment. GIS integration and Case studies-Indian Examples

Unit 4: Introduction to GIS, Datum, Coordinate systems and Projection systems

Spatial data models and data editing, attribute data input and management, data editing, exploration and analysis
 Introduction to DEM analysis

Unit 5: GPS, Concepts of GPS

Integrating GPS data with GIS Applications in earth system sciences
 GPS receivers, GPS position modes- Point positioning and relative positioning, accuracy and error sources.

PRACTICALS:

Course Code: GEO(L) 162
Course Title: Lab: REMOTE SENSING AND GIS

Aerial Photo interpretation, identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms

Introduction to DIP and GIS softwares. Digital Image Processing exercises including analysis of satellite data in different bands and interpretation of various objects on the basis of their spectral signatures
 Creating a FCC from raw data, Registration of satellite data with a toposheet of the area

Enhancing the satellite images; Generating NDVI images and other image ratio and its interpretation
 Classification of images. DEM analysis: generating slope map, aspect map and drainage network map and its applications.

SUGGESTED READINGS:

1. Demers, M.N., 1997. Fundamentals of Geographic Information System, John Wiley & sons. Inc.
2. Hoffmann-Wellenhof, B., Lichtenegger, H. and Collins, J., 2001. GPS: Theory & Practice, Springer Wien New York.
3. Jensen, J.R., 1996. Introductory Digital Image Processing: A Remote Sensing Perspective, Springer- Verlag.
4. Lillesand, T. M. & Kiefer, R.W., 2007. Remote Sensing and Image Interpretation, Wiley.
5. Richards, J.A. and Jia, X., 1999. Remote Sensing Digital Image Analysis, Springer-Verlag.

II. DISCIPLINE SPECIFIC ELECTIVE

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Code: GEO 251
Course Title: EXPLORATION GEOLOGY

THEORY
LECTURES:

Unit 1: Mineral Resources

Resource reserve definitions, Mineral resources in industries – historical perspective and present, A brief overview of classification of mineral deposits with respect to processes of formation in relation to exploration strategies.

Unit 2: Prospecting and Exploration,

Principles of mineral exploration, Prospecting and exploration- conceptualization, methodology and stages, Sampling, subsurface sampling including pitting, trenching and drilling, Geochemical exploration.

Unit 3: Evaluation of data

Evaluation of sampling data
Mean, mode, median, standard deviation and variance

Unit 4: Drilling and Logging

Core and non-core drilling
Planning of bore holes and location of boreholes on ground Core-logging

Unit 5: Reserve estimations and Errors

Principles of reserve estimation, density and bulk density
Factors affecting reliability of reserve estimation
Reserve estimation based on geometrical models (square, rectangular, triangular and polygon blocks)
Regular and irregular grid patterns, statistics and error estimation

PRACTICALS:

Course Code: GEO(L) 251
Course Title: Lab: EXPLORATION GEOLOGY

1. Identification of anomaly
2. Concept of weighted average in anomaly detection
3. Geological cross-section
4. Models of reserve estimation

SUGGESTED READINGS:

1. Clark, G.B. 1967. Elements of Mining. 3rd Ed. John Wiley & Sons.
2. Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4th Ed. Oxford-IBH.
3. Moon, C.J., Whateley, M.K.G., Evans, A.M., 2006, Introduction to Mineral Exploration, Blackwell

Publishing.

1. Lillesand, T. M. & Kiefer, R.W., 2007. Remote Sensing and Image Interpretation, Wiley.
2. Richards, J.A. and Jia, X., 1999. Remote Sensing Digital Image Analysis, Springer-Verlag.

Course Code: GEO 252
Course Title: EARTH AND CLIMATE

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

LECTURES:

Unit 1: Climate system: Forcing and Responses

Components of the climate system

Climate forcing, Climate controlling factors

Climate system response, response rates and interactions within the climate system

Feedbacks in climate system

Unit 2: Heat budget of Earth

Incoming solar radiation, receipt and storage of heat

Heat transformation

Earth's heat budget. Interactions amongst various sources of earth's heat

Unit 3: Response of biosphere to Earth's climate

Climate Change: natural vs. anthropogenic effects

Humans and climate change

Future perspectives

Brief introduction to archives of climate change

Archive based climate change data from the Indian continent

Unit 4: Orbital cyclicality and climate

Milankovitch cycles and variability in the climate

Glacial-interglacial stages The Last Glacial maximum (LGM)

Pleistocene Glacial-Interglacial cycles Younger Dryas Marine isotope stages

Unit 6: Monsoon Mechanism of monsoon

Monsoonal variation through time

Factors associated with monsoonal intensity

Effects of monsoon

PRACTICALS:

Course Code: GEO(L) 252

Course Title: Lab: EARTH AND CLIMATE

1. Study of distribution of major climatic regimes of India on map
2. Distribution of major wind patterns on World map
3. Preparation of paleogeographic maps (distribution of land and sea) of India during specific geological time intervals
4. Numerical exercises on interpretation of proxy records for paleoclimate

SUGGESTED READINGS:

1. Rudiman, W.F., 2001. Earth's climate: past and future. Edition 2, Freeman Publisher.
2. Rohli, R.V., and Vega, A.J., 2007. Climatology. Jones and Barlatt
3. Lutgens, F., Tarbuck, E., and Tasa, D., 2009. The Atmosphere: An Introduction to Meteorology. Pearson Publisher
4. Aguado, E., and Burt, J., 2009. Understanding weather

Course Code: GEO 261
Course Title: FUEL GEOLOGY

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

LECTURES:

Unit 1: Coal

Definition and origin of Coal. Basic classification of coal

Fundamentals of Coal Petrology - Introduction to lithotypes, microlithotypes and macerals in coal

Proximate and Ultimate analysis

Unit 2: Coal as a fuel

Coal Bed Methane (CBM): global and Indian scenario

Underground coal gasification

Coal liquefaction

Unit 3: Petroleum

Chemical composition and physical properties of crudes in nature

Origin of petroleum

Maturation of kerogen; Biogenic and Thermal effect

Unit 4: Petroleum Reservoirs and Traps

Reservoir rocks: general attributes and petrophysical properties.

Classification of reservoir rocks - clastic and chemical.

Hydrocarbon traps: definition, anticlinal theory and trap theory

Classification of hydrocarbon traps - structural, stratigraphic and combination

Time of trap formation and time of hydrocarbon accumulation.

Cap rocks - definition and general properties.

Plate tectonics and global distribution of hydrocarbon reserves

Unit 5: Other fuels

Gas Hydrate- definition, formation, nature of deposits and benefits. Gas hydrates as a sustainable energy resource. Nuclear Fuel

PRACTICALS:

Course Code: GEO(L) 261

Course Title: Lab: FUEL GEOLOGY

1. Study of hand specimens of coal
2. Reserve estimation of coal
3. Section correlation and identification of hydrocarbon prospect
4. Panel and Fence diagrams

SUGGESTED READINGS:

1. Chandra D. (2007). Chandra's Textbook on applied coal petrology. Jijnasa Publishing House.
2. Shelly R. C. (2014). Elements of Petroleum geology: Third Edition, Academic Press
3. Bjorlykke, K. (1989). Sedimentology and petroleum geology. Springer-Verlag.
4. Bastia, R., & Radhakrishna, M. (2012). Basin evolution and petroleum prospectivity of the continental margins of India (Vol. 59). Newnes.

Course Code: GEO 262
Course Title: URBAN GEOLOGY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

LECTURES:

Unit 1: Geology and Society

Urban geology – definition and scope. Necessity of Geology in Urban life.

Geology in Urban Constructions

Geotechnical feature and mapping for subsurface in Metropolitan areas

Building materials, Excavation and cutting in urban areas.

Unit 2: Geology and Urban Agriculture

Soil studies – profile, types and mechanics. Chemistry and geochemistry of soil in relation to ground water and fertilizer

Effect of pollutants on vegetable contamination

Unit 3: Urban land use

Geotechnical site characterization, Geotechnical and land use mapping, Decision making in urban land-use, Geological problems in construction of underground structures in urban areas

Precaution from seismic hazard in Urban planning Seismic Hazards: Micro-zonations of hazard based on engineering geological features, Urban subservice network.

Unit 4: Urban water

Water lagging in built-up areas, Source of water, Standards for various uses of water

Sources of contamination Waste waters: Sources and its disinfection and treatment, Ground water surveys and resource development.

Unit 5: GIS in Urban Geology

GIS – Introduction and Components. Application, advantages and limitations in Urban development, landuse, Groundwater Exploration.

PRACTICALS:

Course Code: GEO(L) 262
Course Title: Lab: URBAN GEOLOGY

1. Map Reading
2. Ground water flow direction estimation
3. Case studies of Urban flood; Flood hydrographs
4. Case studies of urban planning

SUGGESTED READINGS:

1. Huggenberger, P. and Eptin, J. 2011 Urban Geology: Process-Oriented Concepts for Adaptive and Integrated Resource Management. Springer
2. Lollino, G. et al. (Ed.), Engineering Geology for Society and Territory. Springer

III. GENERIC ELECTIVE COURSE (GEC)

Course Code: GEO 311
Course Title: ESSENTIALS OF GEOLOGY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

**THEORY
LECTURES:**

Unit 1: Introduction to geology, scope, sub-disciplines and relationship with other branches of Sciences, General characteristics and origin of the Universe , Meteorites and Asteroids , Cosmic abundance of elements , Distribution of elements in solar system and in Earth

Unit 2: Earth in the solar system, origin
 Earth's size, shape, mass, density, rotational and evolutionary parameters

Solar System- Introduction to Various planets - Terrestrial Planets
 Solar System- Introduction to Various planets - Jovian Planets
 Internal constitution of the earth - core, mantle and crust

Unit 3: Convections in the earth's core and production of magnetic field
 Composition of earth in comparison to other bodies in the solar system, Plate Tectonics
 Concept of plate tectonics, sea-floor spreading and continental drift , Geodynamic elements of Earth- Mid Oceanic Ridges, trenches, transform faults and island arcs

Unit 4: Origin and composition of hydrosphere and atmosphere
 Origin of biosphere
 Origin of oceans, continents and mountains

Unit 5: Age of the earth; Radioactivity and its application in determining the age of the Earth, rocks, minerals and fossils, Standard stratigraphic time scale

PRACTICALS:

Course Code: GEO(L) 311
Course Title: Lab: ESSENTIALS OF GEOLOGY

1. Study of major geomorphic features and their relationships with outcrops through physiographic models.
2. Detailed study of topographic sheets and preparation of physiographic description of an area
3. Study of soil profile of any specific area
4. Study of distribution of major lithostratigraphic units on the map of India
5. Study of distribution of major dams on map of India and their impact on river systems
6. Study of major ocean currents of the World
7. Study of seismic profile of a specific area and its interpretation

SUGGESTED READINGS:

1. Holmes' Principles of Physical Geology. 1992. Chapman & Hall.
2. Emiliani, C,1992. Planet Earth, Cosmology, Geology and the Evolution of Life and Environment. Cambridge University Press.

Course Code: GEO 321
Course Title: ROCKS AND MINERALS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY
LECTURES:

Unit 1: Minerals-Definitions and classifications, Physical properties of minerals, planetary minerals and native elements

Unit 2: Mineral structures – Silicate and non-silicate. Mineralogy of the Earth's crust, mantle and core

Unit 3: Nature of light and principles of optical mineralogy Optical classification of minerals. An overview of environmental and radiation mineralogy, biomineralisation and gemology.

Unit 4: Rocks- Definitions and types, Basics of rock formation. Igneous rock- magma generation and differentiation Sedimentary rocks- surface processes and sedimentary environments

Unit 5: Metamorphic rocks- chemical system and types of metamorphism. Rock cycle-interactions between plate tectonics and climate systems

PRACTICALS:

Course Code: GEO(L) 321
Course Title: Lab: ROCKS AND MINERALS

1. Study of physical properties of minerals
2. Introduction to optical microscopy
3. Study of optical properties of minerals
4. Study of physical properties of rocks
5. Study of optical properties of rock under thin sections
6. Understanding crystal symmetry via wooden models
7. Stereographic projection of mineral faces
8. Mineral formula calculation
9. Crystal chemical calculation
10. Introduction to analytical techniques for rock and mineral study.

SUGGESTED READINGS:

1. Earth Materials- Introduction to Mineralogy and Petrology, Cornelis Klein and Anthony Philpotts, Cambridge University Press, 2013.
2. Understanding Earth (Sixth Edition), John Grotzinger and Thomas H. Jordan, 2010, W.H. Freeman and company, New York.

Course Code: GEO 331
Course Title: EARTH RESOURCES

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY LECTURES:

Unit 1: Earth Resources

Resource reserve definitions; mineral, energy and water resources in industries

Historical perspective and present

A brief overview of classification of mineral deposits with respect to processes of formation in relation to exploration strategies

Unit 2: Definition of Energy: Primary and Secondary Energy

Difference between Energy, Power and Electricity

Renewable and Non-Renewable Sources of Energy

The concept and significance of Renewability: Social, Economic, Political and Environmental Dimension of Energy

Unit 3: Major Types and Sources of Energy

Resources of Natural Oil and Gas

Coal and Nuclear Minerals Potential of Hydroelectric Power, Solar Energy, Wind, Wave and Biomass Based power and Energy

Unit 4: Energy Sources and Power Generation: Nuclear, Hydroelectric, Solar, Wind and Wave- General Principles.

Ground water resources and its role in economic development of a country

Current Scenario and Future Prospects of Solar Power, Hydrogen Power and Fuel Cells.

Unit 5: Plate tectonics and mineral resources. Geologic setting for geographic distribution of important ferrous and non-ferrous metal reserves. Important non-metallic and industrial minerals in India.

PRACTICALS:

Course Code: GEO(L) 331
Course Title: Lab: EARTH RESOURCES

1. Plotting of major Indian oil fields on map of India
2. Problems related to hydroelectric power generation
3. Problems related to assessment of possible oil exploration site from geological maps
4. Problems related to energy demand projection of India and possible mitigation pathways
5. Problems related to biofuel

SUGGESTED READINGS:

1. Energy and the Environment by Fowler, J.M 1984. McGraw-Hill
2. Global Energy Perspectives by Nebojsa Nakicenovic 1998, Cambridge University Press.
3. Energy Resources and Systems: Fundamentals and Non-Renewable Resources by Tushar K. Ghosh and M. A. Prelas. 2009, Springer
4. Introduction to Wind Energy Systems: Hermann-Josef Wagner and Jyotirmay Mathur. 2009, Springer.
5. Renewable Energy Conversion, Transmission and Storage. Bent Sorensen, 2007, Springer.

Course Code: GEO 341
Course Title: EARTH SURFACE PROCESSES

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY LECTURES:

Unit 1: Introduction to Geomorphology: Historical development of geomorphological concepts and Scales in geomorphology, Endogenic and Exogenic processes

Unit 2: Geoid, Topography, Hypsometry, Global Hypsometry, Major Morphological features Large Scale Topography - Ocean basins, Plate tectonics overview, Large scale mountain ranges (with emphasis on Himalaya).

Unit 3: Surficial Processes and geomorphology, Weathering and associated landforms, Hill slopes Glacial, Periglacial processes and landforms, Fluvial processes and landforms, Aeolian Processes and landforms, Coastal Processes and landforms, Landforms associated with igneous activities

Unit 4: Endogenic- Exogenic interactions, Rates of uplift and denudation, Tectonics and drainage development, Sea-level change, Long-term landscape development

Unit 5: Surface processes and natural hazards. Overview of Indian Geomorphology, Extraterrestrial landforms

PRACTICALS:

Course Code: GEO(L) 341
Course Title: Lab: EARTH SURFACE PROCESSES

Mapping of different landforms and interpretation of surface processes

Exercises on hill slope development, fluvial channel, sediment erosion and transport, sediment budgeting, aggradation and degradation events, drainage basin, drainage morphometry

Basic exercises on computation of rate for different surface processes

SUGGESTED READINGS:

1. Alien, P.A., 1997. Earth Surface Processes, Blackwell publishing.
2. Bloom, A.L., 1998. Geomorphology: A Systematic Analysis of Late Cenozoic Landforms, Pearson Education.
3. Bridge, J.S. and Demicco, R.V., 2008. Earth Surface Processes, Landforms and Sediment Deposits, Cambridge University Press.
4. Esterbrook, D.J., 1992. Surface Processes and Landforms, MacMillan Publ.
5. Kale, V.S. and Gupta A 2001 Introduction to Geomorphology, Orient Longman Ltd.
6. Leeder, M. and Perez-Arlucea M 2005 Physical processes in earth and environmental sciences, Blackwell' publishing.
7. Summerfield M A 1991Globe Geomorphology Prentice Hall.
8. Willcock, P.R., Iverson R M (2003) Prediction in geomorphology ' AGU Publication.

IV. SKILL ENHANCEMENT COURSE (SEC)

Course Code: GEO 531
Course Title: FIELD GEOLOGY –I (Basic field training)

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

**THEORY
LECTURES:**

Unit 1: Orientation of Topographic sheet in field, marking location in toposheet, Bearing (Front and back). Concepts of map reading, Distance, height and pace approximation

Unit 2: Identification of rock types in field; structures and texture of rocks, Use of hand lense

Unit 3: Basic field measurement techniques: Bedding dip and strike, Litholog measurement

Unit 4: Reading contours and topography

Course Code: GEO 541

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Course Title: FIELD GEOLOGY –II (Geological Mapping)

Unit 1: Geological mapping, stratigraphic correlation

Unit 2: Primary (scalars and vectors) and secondary structures (linear and planar)

Unit 3: Trend, plunge, Rake/Pitch

Unit 4: Stereoplots of linear and planar structures, Orientation analyses.

MATHEMATICS HONOURS

| Semester | Core Course | Ability Enhancement Course | Skill Enhancement course | Discipline Specific Elective Course | Generic Elective Course |
|-------------------------|---|----------------------------|--|--|-----------------------------------|
| I | MAT-111 Calculus | English Communication | | | MAT-311 Calculus |
| | MAT-112 Algebra | | | | |
| II | MAT-121 Real Analysis-1 | Environmental Studies | | | MAT-321 Differential Equations |
| | MAT-122, Differential Equations | | | | |
| III | MAT-131 Real Analysis-2 | | MAT-531 (Choose one) 1. LaTeX and HTML 2.Graph Theory 3.Logic and sets | | MAT-331: Multivariate Calculus |
| | MAT-132 Group Theory-1 | | | | |
| | MAT-133: Multivariate Calculus | | | | |
| IV | MAT-141: Numerical Methods | | MAT-541 (Choose one) 1.Computer Algebra System and related software 2.Transportation and Game Theory. | | MAT-341: Numerical Methods |
| | MAT-142: Real Analysis-3 | | | | |
| | MAT-143: Group Theory-2 | | | | |
| V | MAT-151: Partial Differential Equations and system of ordinary Differential Equation | | | MAT-251 (Choose one) 1.Coordinate Geometry 2. Number Theory 3. C++ Programming | |
| | MAT-152: Ring Theory and Linear Algebra | | | MAT-252 (Choose one) 1.Modeling and Simulation 2.Integral Transform | |
| VI | MAT-161: Metric Spaces | | | MAT-261 (Choose one) 1)Bio-Mathematics 2)Linear - Programming | |
| | MAT-162: Complex Analysis | | | MAT-262 (Choose one) 1.Application of Algebra 2.Fluid Dynamics. | |
| No. of Courses (Credit) | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |

I. CORE COURSE

Course code: MAT-111

COURSE TITLE: Calculus

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Marking system:

| | Theory (4-credits) | Practicals(2-credits) |
|--------------------|--------------------|-----------------------|
| End semester | 70 | 35 |
| CIA | 30 | 15 |
| Total marks | 100 | 50 |

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)

Lab Record/note book : 5 marks (CIA)

End semester exam : 35 marks

THEORY**UNIT-1**

(12-HOURS)

Hyperbolic functions- Definitions and Identities, Derivatives and Integrals; Inverse Hyperbolic Functions- Derivatives and Integrals., Higher order derivatives, Leibnitz Theorem and its applications, The first derivative test, concavity and inflection points, Second derivative test, Curve sketching using first and second derivative test, limits at infinity, graphs with asymptotes, curvature, L'Hospital's rule, applications in business, economics and life sciences.

UNIT-2

(12-HOURS)

Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates. Reduction formulae, derivations and illustrations of reduction formulae of the type

UNIT-3

(12-HOURS)

$$\int \sin^n x dx, \int \cos^n x dx, \int \tan^n x dx, \int \sec^n x dx, \int \operatorname{cosec}^n x dx, \int \sin^n x \cos^m x dx, \int \frac{dx}{(a+b\cos x)^n}$$

Volumes by slicing; disks and washers methods, Volumes by cylindrical shells. Arc length, arc length of parametric curves, Area of surface of revolution

UNIT-4

(12-HOURS)

Techniques of sketching conics, reflection properties of conics, Rotation of axes and second degree equations, classification into conics using the discriminant, Polar equation of conics.

UNIT-5

(12-HOURS)

Introduction to vector functions and their graphs, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions. Modeling ballistics and planetary motion, Kepler's second law. Tangential and normal components of acceleration.

REFERENCES:

M. J. Strauss, G. L. Bradley and K. J. Smith, *Calculus* (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.

H. Anton, I. Bivens and S. Davis, *Calculus* (7th Edition), John Wiley and sons (Asia), Pt Ltd., Singapore, 2002.

G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.

R. Courant and F. John, *Introduction to Calculus and Analysis* (Volumes I & II), Springer-Verlag, New York, Inc., 1989.

PRACTICAL

List of practicals(using Scilab/Matlab/ Mathematica/Maple)

Plotting of graphs of function

and to illustrate the effect of _____ on the graph.

Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.

Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid)

Obtaining surface of revolution of curves.

Tracing of conics in cartesian coordinates/ polar $e^{ax+b}, \log(ax+b), \sin(ax+b), \cos(ax+b)$, coordinates.

Sketch- $ax+b$ ing ellipsoid, hyperboloid of one and a and b two sheets, elliptic cone, elliptic, paraboloid, hyperbolic paraboloid using Cartesian coordinates.

n^{th} derivative without Leibnitz rule.

n^{th} derivative with Leibnitz rule. \Programs for evaluate area and volume

Evaluation of limits by L'Hospital's rule using Scilab/Matlab.

Graph of Hyperbolic functions.

Computation of limit, differentiation and integration of vector functions.

Note: The above list may be changed annually with the approval of the BUGS (Mathematics).

Course code: MAT-112
 COURSE TITLE: Algebra

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Marking system:

| | Theory (4-credits) | Practicals(2-credits) |
|--------------------|--------------------|-----------------------|
| End semester | 70 | 35 |
| CIA | 30 | 15 |
| Total marks | 100 | 50 |

Marks distribution (Theory):

Internal exam : 10 marks (CIA)
 Short test/quiz : 10 marks (CIA)
 Assignment/activity/minor project : 10 marks (CIA)
 End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)
 Lab Record/note book : 5 marks (CIA)
 End semester exam : 35 marks

THEORY

UNIT-1 (12-HOURS)

Polar representation of complex numbers, n^{th} roots of unity, De Moivre's theorem for rational indices and its applications.

UNIT-2 (12HOURS)

Equivalence relations, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set, Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm, Congruence relation between integers, Principles of Mathematical Induction.

UNIT-3 (12-HOURS)

Theory of equations – Euclid's algorithm – Polynomials with integral coefficients – Remainder theorem – Factor theorem – Fundamental theorem of algebra(statement only) – Irrational and complex roots occurring in conjugate pairs – Relation between roots and coefficients of a polynomial equation – symmetric functions – transformation – Reciprocal equations – Descartes' rule of signs – multiple roots – solving cubic equations by Cardon's method – solving quartic equations by Descarte's Method.

UNIT-4 (12 HOURS)

Introduction to matrices, different types of matrices, operations on matrices, Theorems on matrices, Elementary operations on matrices and types of matrices, Symmetric and skew-symmetric matrices, Hermitian and skew-hermitian matrices. Linear dependence and independence of row and column matrices. Row rank, column rank and rank of a matrix. Row Reduced Echelon (RRE) form of a matrix and matrix inversion using it.

UNIT-5

(12-HOURS)

Eigen values, Eigen vectors and the characteristic equation of a matrix. Cayley-Hamilton (CH) theorem and its use in finding inverse of a matrix. Application of matrices in solving a system of simultaneous linear equations. Cramer's rule. Theorems on consistency of a system of simultaneous linear equations.

REFERENCES:

1. Titu Andreescu and Dorin Andrica, *Complex Numbers from A to Z*, Birkhauser, 2006.
2. Edgar G. Goodaire and Michael M. Parmenter, *Discrete Mathematics with Graph Theory (3rd Edition)*, Pearson Education (Singapore) Pvt. Ltd., Indian Reprint, 2005
3. David C. Lay, *Linear Algebra and its Applications (3rd Edition)*, Pearson Education Asia, Indian Reprint, 2007
4. Shanti Narayan and P K Mittal, *Text book of Matrices*, 5th edition, New Delhi, S.Chand and Co. Pvt. Ltd., 2013.
5. B S Vatssa, *Theory of Matrices*, New Delhi: New Age International Publishers, 2005
6. *Matrix and Linear Algebra* – K. B. Dutta, Prentice Hall
7. W.S. Burnside and A.W. Panton, *The Theory of Equations*, Dublin University Press, 1954
8. C. C. MacDuffee, *Theory of Equations*, John Wiley & Sons Inc., 1954
9. S.K.Mapa, *Higher Algebra (Classical)*, Asoke Prakashan, Kolkatta
10. J.G. Chakravorty and P.R.Ghosh, *Advanced Higher Algebra*, U.N.Dhur & Sons Pvt.Ltd
11. Bernard & Child, *Higher Algebra*.

PRACTICAL

1. List of practicals (using Scilab/Matlab/ Mathematica/Maple)
2. Complex numbers and their representations, operations like addition, multiplication, division, modulus. Graphical representation of polar form.
3. Application of De'Morve's theorem
4. Application of roots of complex number
5. Application of $\sin^n \theta$ and $\cos^n \theta$ in terms of series of sine and cosine respectively
6. Application of $\sin(n\theta)$ and $\cos(n\theta)$ in terms of series of sine and cosine.
7. Application of $\tan(n\theta)$ in terms of series of tangent.
8. Matrix operation (addition, multiplication, inverse, transpose)
9. Find RRE form and rank of a matrix
10. Find inverse using Gauss Jordan method(using row operations)
11. Verify the Cayley-Hamilton(CH) theorem – inverse of matrix using it- problems on CH theorem.
12. Find Eigen values and Eigen vectors
13. Solution of system of linear equations using row operations and Cramer's rule
14. To make a presentation on relations between roots and coefficients of a polynomial equation in one variable.
15. To make a presentation on Cardon's method.

REFERENCES:

Peter I. Kattan, MATLAB for beginners; A Gentle Approach, Revised Edn., Petra books

Course code: MAT-121**COURSE TITLE: Real Analysis- I**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Total marks: 100 (Theory + Tutorial)

Marking system:

Marks distribution-

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

UNIT-1

Algebraic and Order Properties of \mathbb{R} , δ -neighborhood of a point in \mathbb{R} , Idea of countable sets, uncountable sets and uncountability of \mathbb{R} .

UNIT-2

Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of \mathbb{R} , The Archimedean Property, Density of Rational (and Irrational) numbers in \mathbb{R} , Intervals.

UNIT-3

Neighbourhood, Open set, Interior of a set, Closed set, Limit points of a set, Isolated points, Derived set, Closure of a set, Bolzano-Weierstrass theorem for sets.

UNIT-4

Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem, Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.

UNIT-5

Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's nth root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

REFERENCES:

1. R.G. Bartle and D. R. Sherbert, *Introduction to Real Analysis* (3rd Edition), John Wiley and Sons (Asia) Pvt. Ltd., Indian Edition, 2012
2. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough, *An Introduction to Analysis*, Jones & Bartlett, Second Edition, 2010.
3. Brian S. Thomson, Andrew. M. Bruckner, and Judith B. Bruckner, *Elementary Real Analysis*, Prentice Hall, 2001.
4. S.K. Berberian, *A First Course in Real Analysis*, Springer Verlag, New York, 1994.
5. Sudhir R. Ghorpade and Balmohan V. Limaye, *A course in Calculus and Real Analysis*, undergraduate Text in Maths., Springer, Indian Reprint-2004.
6. A. Kumar and S. Kumaresan, *A Basic course in Real Analysis*, CRC press(Chapman & Hall book), special Indian Edition-2014

TUTORIAL

Problem solving session

Course code: MAT-122**COURSE TITLE: Differential Equations (P)**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)

Lab Record/note book : 5 marks (CIA)

End semester exam : 35 marks

THEORY**UNIT-1** (12-Hours)

Differential equations and mathematical models, order and degree of a differential equation, General, particular, explicit, implicit and singular solutions of a differential equation; First order and first degree ODE (variables separable, homogeneous, exact, linear, Bernoulli equations, special integrating factors); Equations of first order but of higher degree, reducible second order differential equations, application of first order differential equations to acceleration-velocity model, Growth and Decay model, Chemical Reactions, Heat flow, Oxygen debt, Economics.

UNIT-2 (12-Hours)

Introduction to compartmental models, lake pollution model (with case study of Lake Burley Griffin), drug assimilation into the blood (case of a single cold pill, case of a course of cold pills, case study of alcohol in the bloodstream), exponential growth of population, limited growth of population, limited growth with harvesting.

UNIT-3 (12-Hours)

General solution of homogeneous equation of second order, principle of superposition for a homogeneous equation; Wronskian, its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters, applications of second order differential equations to mechanical vibrations.

UNIT-4 (12-Hours)

Power series solutions of second order differential equations.

UNIT-5 (12-Hours)

Laplace transforms and its applications to solutions of differential equations.

PRACTICAL / LAB WORK

1. List of Practicals (using MATLAB/MATHEMATICA/MAPLE)
2. Plotting of second order solution family of differential equation.
3. Plotting of third order solution family of differential equation.
4. Growth model (exponential case only).
5. Decay model (exponential case only).
6. Oxygen debt model.
7. Economic model.
8. Vibration problems.
9. Lake pollution model (with constant/seasonal flow and pollution concentration)
10. Drug assimilation into the blood (Case of single cold pill and a course of cold pills)
11. Limited growth of population (with and without harvesting).
12. Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.

Book Recommended:

1. **C. H. Edwards** and **D. E. Penny**, *Differential Equations and Boundary Value Problems: Computing and Modeling*, Pearson Education, India, 2005.
2. **Belinda Barnes** and **Glenn R. Fulford**, *Mathematical Modeling with Case Studies, A Differential Equation Approach Using Maple*, Taylor and Francis, London and New York, 2002.
3. **S. L. Ross**, *Differential Equations*, John Wiley and Sons, India, 2004.
4. **G. Dennis Zill**, *A First Course in Differential Equations with Modelling Applications*, Cengage Learning India Pvt. Ltd.
5. **J. Sinha Roy** and **S. Padhy**, *A Course of Ordinary and Partial Differential Equations*, Kalyani publishers, New Delhi
6. Martha L Abell, James P Braselton, *Differential Equations with MATHEMATICA*, 3rd Ed., Elsevier Academic Press, 2004.

Course code: MAT-131**COURSE TITLE: Real Analysis-II**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Total marks: 100 (Theory+ Tutorial)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

THEORY**UNIT-1**

Limits of functions ($\varepsilon - \delta$ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity, Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions.

UNIT-2

Continuous functions on an interval, intermediate value theorem, location of roots theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem.

UNIT-3

Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum theorem.

UNIT-4

Rolle's theorem, Mean value theorem, intermediate value property of derivatives, Darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials, Taylor's theorem to inequalities. Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder.

UNIT-5

Application of Taylor's theorem to convex functions, relative extrema. Taylor's series and

Maclaurin's series expansions of exponential and trigonometric functions, $\ln(1+x)$, $\frac{1}{ax+b}$

and $(1+x)^n$

Books Recommended

1. R. Bartle and D.R. Sherbert, *Introduction to Real Analysis*, John Wiley and Sons, 2003.
2. K.A. Ross, *Elementary Analysis: The Theory of Calculus*, Springer, 2004.
3. A. Mattuck, *Introduction to Analysis*, Prentice Hall, 1999.
4. S.R. Ghorpade and B.V. Limaye, *A Course in Calculus and Real Analysis*, Springer, 2006.

TUTORIAL

Problem solving session

Course code: MAT-132
COURSE TITLE: Group Theory-I

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Total marks: 150 (Theory+ Tutorial)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

THEORY

UNIT-1

Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (illustration through matrices), elementary properties of groups.

UNIT-2

Subgroups and examples and theorems on subgroups, normal subgroup, centralizer, normalizer, center of a group.

UNIT-3

Properties of cyclic groups, classification of subgroups of cyclic groups. Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group. properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem.

UNIT-4

External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

UNIT-5

Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.

Books Recommended

1. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
2. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.
3. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa Publishing House, New Delhi, 1999.
4. Joseph J. Rotman, *An Introduction to the Theory of Groups*, 4th Ed., Springer Verlag, 1995.
5. I.N. Herstein, *Topics in Algebra*, Wiley Eastern Limited, India, 1975.

TUTORIAL

Problem solving session

Course code: MAT-133

COURSE TITLE: Multivariate Calculus(P)

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)

Lab Record/note book : 5 marks (CIA)

End semester exam : 35 marks

THEORY**UNIT-1**

(12 Hrs)

Functions of several variables, limit and continuity of functions of two variables Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters, directional derivatives.

Unit-2

(12 Hrs)

The gradient, maximal and normal property of the gradient, tangent planes; Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems.

Unit-3

(12 Hrs)

Definition of vector field, divergence and curl and its related properties.

Unit-4

(12 Hrs)

Double integration over rectangular region, double integration over nonrectangular region. Double integrals in polar co-ordinates, Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical co-ordinates

Unit-5

(12 Hrs)

Line integrals, Applications of line integrals: Mass and Work. Fundamental theorem for line integrals, conservative vector fields, independence of path. Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stokes' theorem, The Divergence theorem.

Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, *Calculus*, 3rd Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
3. E. Marsden, A.J. Tromba and A. Weinstein, *Basic Multivariable Calculus*, Springer (SIE), Indian reprint, 2005.
4. James Stewart, *Multivariable Calculus, Concepts and Contexts*, 2nd Ed., Brooks /Cole,
5. Thomson Learning, USA, 2001.

PRACTICAL**Practical / Lab work to be performed on a computer.**

Modeling of the following problems using *Matlab / Mathematica / Maple* etc.

1. Draw the following surfaces and find level curves at the given heights:
2. Draw the given surfaces and discuss whether limit exists or not as x approaches to the given points. Find the limit, if it exists:
3. Draw the tangent plane to the given surfaces at the given points.
4. Use an incremental approximation to estimate the given functions at the given point and compare it with calculated value.
5. Find critical points and identify relative maxima, relative minima or saddle points to the given surfaces, if it exist:

Course code: MAT-141
COURSE TITLE: Numerical Methods

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)
 Short test/quiz : 10 marks (CIA)
 Assignment/activity/minor project : 10 marks (CIA)
 End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)
 Lab Record/note book : 5 marks (CIA)
 End semester exam : 35 marks

THEORY**UNIT-1**

Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation, Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods

UNIT-2

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis

UNIT-3

Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.

UNIT-4

Numerical Integration: Trapezoidal rule, Simpson's rule, Simpson's 3/8th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule

UNIT-5

Ordinary Differential Equations: Euler's method. Runge-Kutta methods of orders two and four.

PRACTICALS

Use of computer aided software (CAS), for example *Matlab / Mathematica / Maple / Maxima* etc., for developing the following Numerical programs

1. Calculate the sum $\frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n}$
2. To find the absolute value of an integer.
3. Enter 100 integers into an array and sort them in an ascending order
4. Any two of the following
 5. (a) Bisection Method
 6. (b) Newton Raphson Method
 7. (c) Secant Method
 8. (d) Regulai Falsi Method
9. LU decomposition Method
10. Gauss-Jacobi Method
11. SOR Method or Gauss-Siedel Method
12. Lagrange Interpolation or Newton Interpolation
13. Simpson's rule

NOTE: For any of the CAS *MATLAB / Mathematica / Maple / Maxima* etc., Data types-simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, input/output, relational operators, logical operators and logical expressions, control statements and loop statements, Arrays should be introduced to the students.

Books Recommended:

1. Richard L. Faires, J. Douglas Burden, Numerical Analysis, 8th Edn, Brookes Cole, USA.
2. Brian Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 6th Ed., New age International Publisher, India, 2007.
4. C.F. Gerald and P.O. Wheatley, *Applied Numerical Analysis*, Pearson Education, India, 2008.
5. Uri M. Ascher and Chen Greif, *A First Course in Numerical Methods*, 7th Ed., PHI Learning Private Limited, 2013
6. John H. Mathews and Kurtis D. Fink, *Numerical Methods using Matlab*, 4th Ed., PHI Learning Private Limited, 2012

Course code: MAT-142
COURSE TITLE: Real Analysis-III

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Total marks: 100 (Theory + Tutorial)
 Marking system:

Marks distribution:

Internal exam : 10 marks (CIA)
 Short test/quiz : 10 marks (CIA)
 Assignment/activity/minor project : 10 marks (CIA)
 End semester exam : 70 marks

THEORY

UNIT-1

Riemann integration; inequalities of upper and lower sums; Riemann conditions of integrability. Riemann sum and definition of Riemann integral through Riemann sums; equivalence of two definitions; Riemann integrability of monotone and continuous functions, Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorems of Calculus.

UNIT-2

Improper integrals; Convergence of Beta and Gamma functions.

UNIT-3

Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions.

UNIT-4

Series of functions; Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test

UNIT-5

Limit superior and Limit inferior. Power series, radius of convergence, Cauchy Hadamard Theorem, Differentiation and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem.

Books Recommended

1. K.A. Ross, *Elementary Analysis, The Theory of Calculus*, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
2. R.G. Bartle D.R. Sherbert, *Introduction to Real Analysis*, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
3. Charles G. Denlinger, *Elements of Real Analysis*, Jones & Bartlett (Student Edition), 2011.

TUTORIAL

Problem solving session

Course code: MAT-143**COURSE TITLE: Group Theory-2**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Total marks: 100 (Theory + Tutorial)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

THEORY**UNIT-1**

Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups, Characteristic subgroups, Commutator subgroup and its properties

UNIT-2

Properties of external direct products, the group of units modulo n as an external direct product, internal direct products, Fundamental Theorem of finite abelian groups

UNIT-3

Group actions, stabilizers and kernels, permutation representation associated with a given group action, Applications of group actions: Generalized Cayley's theorem, Index theorem.

UNIT-4

Groups acting on themselves by conjugation, class equation and consequences, conjugacy in S_n , p -groups.

UNIT-5

Sylow's theorems and consequences, Cauchy's theorem, Simplicity of A_n for $n \geq 5$, non-simplicity tests.

Books Recommended

1. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa Publishing House, 1999
2. David S. Dummit and Richard M. Foote, *Abstract Algebra*, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2004.
3. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011
4. J.R. Durbin, *Modern Algebra*, John Wiley & Sons, New York Inc., 2000
5. D. A. R. Wallace, *Groups, Rings and Fields*, Springer Verlag London Ltd., 1998

TUTORIAL

Problem solving session

Course code: **MAT-151**

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

COURSE TITLE: Partial Differential Equations and System of Ordinary Differential Equations

Total marks: 150 (Theory+ practical)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)

Lab Record/note book : 5 marks (CIA)

End semester exam : 35 marks

PART-A
THEORY

UNIT-1

Introduction, classification, construction and geometrical interpretation of first order partial differential equations (PDE), method of characteristic and general solution of first order PDE, canonical form of first order PDE, method of separation of variables for first order PDE.

UNIT-2

Mathematical modeling of vibrating string, vibrating membrane, conduction of heat in solids, gravitational potential, conservation laws and Burger's equations, classification of second order PDE, reduction to canonical forms, equations with constant coefficients, general solution

UNIT-3

Cauchy problem for second order PDE, homogeneous wave equation, initial boundary value problems, non-homogeneous boundary conditions, finite strings with fixed ends, non-homogeneous wave equation, Riemann problem, Goursat problem, spherical and cylindrical wave equation

UNIT-4

Method of separation of variables for second order PDE, vibrating string problem, existence and uniqueness of solution of vibrating string problem, heat conduction problem, existence and uniqueness of solution of heat conduction problem, Laplace and beam equation, non-homogeneous problem.

UNIT-5

Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients, Basic Theory of linear systems in normal form, homogeneous linear systems with constant coefficients: Two Equations in two unknown functions, The method of successive approximations, the Euler method, the modified Euler method, The Runge-Kutta method.

PART-B

PRACTICALS

List of Practicals (using any software)

Solution of Cauchy problem for first order PDE.

To find the characteristics for the first order PDE

Plot the integral surfaces of a given first order PDE with initial data

$$\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$$

Solution of wave equation for the following associated conditions

$$u(x, 0) = \phi(x), \quad u_t(x, 0) = \psi(x), \quad x \in \mathbb{R}, \quad t > 0$$

$$u(x, 0) = \phi(x), \quad u_t(x, 0) = \psi(x), \quad u(0, t) = 0, \quad x \in (0, \infty), \quad t > 0$$

$$u(x, 0) = \phi(x), \quad u_t(x, 0) = \psi(x), \quad u_x(0, t) = 0, \quad x \in (0, \infty), \quad t > 0$$

$$u(x, 0) = \phi(x), \quad u_t(x, 0) = \psi(x), \quad u(0, t) = 0, u(1, t) = 0, 0 < x < 1, \quad t > 0$$

$$\frac{\partial u}{\partial t} - k^2 \frac{\partial^2 u}{\partial x^2} = 0$$

Solution of wave equation for the following associated conditions

$$u(x, 0) = \phi(x), \quad u(0, t) = a, \quad u(l, t) = b, 0 < x < l, \quad t > 0$$

$$u(x, 0) = \phi(x), x \in \mathbb{R}, \quad 0 < t < T$$

$$u(x, 0) = \phi(x), \quad u(0, t) = a, x \in (0, \infty), \quad t \geq 0$$

Solving the system of ODEs

Approximating solution to Initial Value Problems using any of the following approximate methods:

The Euler Method

The Modified Euler Method.

The Runge-Kutta Method.

Comparison between exact and approximate results for any representative differential equation

Books Recommended:

1. Tyn Myint-U and Lokenath Debnath, *Linear Partial Differential Equations for Scientists and Engineers*, 4th edition, Springer, Indian reprint, 2006.
2. S.L. Ross, *Differential equations*, 3rd Ed., John Wiley and Sons, India, 2004
3. T. Amaranath, *An Elementary Course in Partial Differential Equations*, 2nd Edn., Narosa Publication House, New Delhi-2013.
4. Brian R. Hunt, Ronald L . Lipsman, John E.Osborn, Jonathan M.Rosenberg, *Differential Equations with MATLAB*, 2nd Edn., John Wiley& Sons,Inc., US.
5. Cesar Pérez López, *MATLAB Programming for Numerical Analysis*, springer.
6. Martha L Abell, James P Braselton, *Differential equations with MATHEMATICA*, 3rd Ed., Elsevier Academic Press, 2004.
7. Ioannis P Stavroulakis and Stepan A Tersian, *Partial Differential Equations: An Introduction with Mathematica and MAPLE*, World Scientific, Second Edition, 2004.

Course code: MAT-152**COURSE TITLE: Ring Theory and Linear Algebra**

Total marks: 100 (Theory + Tutorial)

Marking system:

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Marks distribution:

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

THEORY**UNIT-1**

Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

UNIT-2

Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I, II and III, field of quotients.

UNIT-3

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

UNIT-4

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

Unit-5

Dual spaces, transpose of a linear transformation and its matrix in the dual basis, annihilators, Eigen spaces of a linear operator, diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator.

Books Recommended:

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra* (4th Edition), Prentice-Hall of India Pvt. Ltd., New Delhi, 2004
2. S. Lang, *Introduction to Linear Algebra*, 2nd Ed., Springer, 2005
3. Kenneth Hoffman, Ray Alden Kunze, *Linear Algebra*, 2nd Ed., Prentice-Hall of India Pvt.Ltd., 1971.
4. Gilbert Strang, *Linear Algebra and its Applications*, Thomson, 2007
5. S. Kumaresan, *Linear Algebra- A Geometric Approach*, Prentice Hall of India, 1999

TUTORIAL

Problem solving session

Course code: MAT-161
COURSE TITLE: Metric Spaces

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Total marks: 100 (Theory + Tutorial)
 Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)
 Short test/quiz : 10 marks (CIA)
 Assignment/activity/minor project : 10 marks (CIA)
 End semester exam : 70 marks

THEORY

UNIT-1

Metric spaces: definition and examples. Sequences in metric spaces, Cauchy sequences. Complete Metric Spaces.

UNIT-2

Open and closed balls, neighbourhood, open set, interior of a set, Limit point of a set, closed set, diameter of a set, Cantor's Theorem, Subspaces, dense sets, separable spaces.

UNIT-3

Continuous mappings, sequential criterion and other characterizations of continuity, Uniform continuity, Homeomorphism, Contraction mappings, Banach Fixed point Theorem.

UNIT-4

Connectedness, connected subsets of \mathbf{R} , connectedness and continuous mappings

UNIT-5

Compactness, compactness and boundedness, continuous functions on compact spaces.

Books Recommended:

1. Satish Shirali & Harikishan L. Vasudeva, Metric Spaces, Springer Verlag London (2006) (First Indian Reprint 2009)
2. Micheal O. Searcoid, Metric Spaces, Springer, 2008 Indian Edn.
3. S. Kumaresan, Topology of Metric Spaces, Narosa Publishing House, Second Edition 2011
4. G. F. Simmons, Introduction to Topology and Modern Analysis, Mcgraw-Hill, Edition 2004

TUTORIAL

Problem solving session

Course code: MAT-162**COURSE TITLE: Complex Analysis**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Total Credits : 6 (Theory 4 ; practical 2 credits)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)

Lab Record/note book : 5 marks (CIA)

End semester exam : 35 marks

PART-A**THEORY****UNIT-1**

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability

UNIT-2

Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions

UNIT-3

Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals, Antiderivatives, proof of antiderivative theorem, Cauchy-Goursat theorem, Cauchy integral formula. An extension of Cauchy integral formula, consequences of Cauchy integral formula, Liouville's theorem and the fundamental theorem of algebra

UNIT-4

Convergence of sequences and series, Taylor series and its examples. Laurent series and its examples, absolute and uniform convergence of power series, uniqueness of series representations of power series

UNIT-5

Isolated singular points, residues, Cauchy's residue theorem, residue at infinity. Types of isolated singular points, residues at poles and its examples, definite integrals involving sines and cosines

PART-B**PRACTICALS****LIST OF PRACTICALS (MODELING OF THE FOLLOWING PROBLEMS USING MATLAB/ MATHEMATICA/ MAPLE ETC)**

1. Declaring a complex number and graphical representation e.g. $z_1 = 3 + 4i, z_2 = 4 - 7i$
2. Program to discuss the algebra of complex numbers
3. To find conjugate, modulus and phase angle of an array of complex numbers
e.g., $Z = [2 + 3i \quad 4 - 2i \quad 6 + 11i \quad 2 - 5i]$
4. To compute the integral over a straight line path between the two specified end points
5. To compute contour integration.
6. To plot the complex functions and analyze the graph
7. To perform the Taylor series expansion of a given function $f(z)$ around a given point z .
8. The number of terms that should be used in the Taylor series expansion is given for each function. Hence plot the magnitude of the function and magnitude of its Taylor series expansion.
e.g., (i) $f(z) = \exp(z)$ around $z = 0, n = 40$.
(ii) $f(z) = \exp(z^2)$ around $z = 0, n = 168$
9. To perform Laurents series expansion of a given function $f(z)$ around a given point z .
10. To compute the poles and corresponding residues of complex functions
11. To determine how many terms should be used in the Taylor series expansion of a given function $f(z)$ around $z = 0$ for a specific value of z to get a percentage error of less than 5%.
e.g., For $f(z) = \exp(z)$ around $z = 0$, execute and determine the number of necessary terms to get a percentage error of less than 5% for the following values of z :
(i) $z = 30 + 30i$
(ii) $z = 20 + 40i$

Books Recommended:

1. James Ward Brown and Ruel V. Churchill, *Complex Variables and Applications* (Eighth Edition), McGraw – Hill International Edition, 2009
- 2.
3. Joseph Bak and Donald J. Newman, *Complex analysis* (2nd Edition), Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997
4. Lars V. Ahlfors, *Complex Analysis*, McGraw Hill, 3rd Indian Edition, 2013.
5. Murray R. Spiegel, Seymour Lipschutz, J. j.Schiller, D.Spellman, *Complex Variables*, Schaum's series, 2nd Edn. 2009. Indian Edn.

II. DISCIPLINE SPECIFIC ELECTIVE COURSE (DSEC)

Course code: MAT-251

COURSE TITLE: Coordinate Geometry

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Total marks: 100 (Theory + Tutorial)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

THEORY**UNIT-1**

Transformation of coordinate axes, Pair of straight lines.

UNIT-2

Circle: parametric form, tangent and normal, pole and polar, orthogonal circle, condition of orthogonality of circles; equation of parabola and its parametric form, tangent and normal.

Ellipse: tangent and normal, conjugate diameters; hyperbola and its asymptotes.

UNIT-3

General-conics: tangent, condition of tangency, pole and polar, centre of a conic, equation of pair of tangents, reduction to standard forms, central conics, equation of the axes, and length of the axes, Polar equation of a conic, tangent and normal and properties.

UNIT-4

Sphere, cone and cylinder

UNIT-5

Central conicoids, Reduction of general equation of second degree, Tangent plane and normal to a conicoid, Pole and polar, Conjugate diameters, Generating lines, Plane sections.

Recommended readings:

1. Analytical Geometry(2D) by E.H. Askwith.
2. Analytical Geometry by B. Das.
3. Analytical Geometry by Shanti Narayan– S Chand & co.
4. Analytical Geometry of two and three dimension and Vector analysis by R. M. Khan - New Central Book agency.
5. Analytical Geometry of two and three dimension– J. C. Chakraborty & Ghose, U. N. Dhur & sons
6. S. L. Loney: the elements of coordinate geometry. Macmillan and company, London.

TUTORIAL

Problem solving session

Course code: MAT-252
COURSE TITLE: Number Theory

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Total marks: 100 (Theory + Tutorial)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

UNIT-1

Divisibility, Greatest common divisor, Euclidean Algorithm, The fundamental theorem of arithmetic, congruences, special divisibility tests, Chinese remainder theorem, Fermat's little theorem, Wilson's theorem, residue classes and reduced residue classes.

Unit-2

Euler's theorem, An application to cryptography, (n) , Mobius inversion formula, The greatest integer function, $u(n), \sigma(n), d(n), \phi$ arithmetic functions, perfect numbers, Mersene primes, Fermat numbers, primitive roots and indices, Quadratic residues.

UNIT-3

Legendre Symbol, Quadratic reciprocity law, Jacobi symbol, Binary quadratic forms and their reduction, sums of two and four squares, positive definite binary quadratic forms, Diophantine equations $ax + by = c, x^2 + y^2 = z^2, x^4 + y^4 = z^4$

Unit-4

Order of magnitude and average order of arithmetic functions, Euler's summation formula, Abel's Identity, Elementary results on distribution of primes, Residue classes and Euler's function, Linear congruences and congruence of higher degree.

UNIT-5

Congruences with prime moduli, Number theoretic function, The symbol O and their basic properties.

REFERENCES:

1. **David M. Burton**, *Elementary Number Theory* (6th Edition), Tata McGraw-Hill Edition, Indian reprint, 2007.
2. **Neville Robinns**, *Beginning Number Theory* (2nd Edition), Narosa Publishing House Pvt. Limited, Delhi, 2007.

TUTORIAL

Problem solving session

Course code: MAT-253**COURSE TITLE: C++ PROGRAMMING**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)
 Short test/quiz : 10 marks (CIA)
 Assignment/activity/minor project : 10 marks (CIA)
 End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)
 Lab Record/note book : 5 marks (CIA)
 End semester exam : 35 marks

PART-A**THEORY****UNIT-1**

Principles of Object Oriented Programming (OOP) : Evolution of C++ -Programming Paradigms - Key Concepts of OOP - Advantages of OOP -Usage of OOP and C++ .Input and Output in C++-Streams-Stream classes Unformatted console I/O operations-Member functions of istream lassmanipulators-manipulators with parameters

UNIT-2

Introduction to C++; Tokens, Keywords, Identifiers, Variables, Operators, Expressions and Control Structures: If, If..Else, Switch – Repetitive Statements for, while, do..while- Pointers and arrays

UNIT-3

Functions in C++ - Main Function - Function Prototyping - Parameters Passing in Functions - Values Return by Functions - inline Functions - Function Overloading Classes and Objects; Constructors and Destructors; and Operator Overloading - Type of Constructors

UNIT-4

Inheritance: Single Inheritance - Multilevel inheritance - Multiple inheritance-Hierarchical Inheritance- Hybrid Inheritance. Pointers - Virtual Functions and Polymorphism

UNIT-5

Working with Files: Classes for File Stream Operations - Opening and Closing a File - End-of-File Detection - File Pointers - Updating a File - Error Handling during File Operations - Command-line Arguments

Books Recommended:

1. Ashok N.Kamthane, Object Oriented Programming with ANSI & Turbo C++, Pearson Education, 2006
2. E. Balguruswamy, “ C++ “, Tata McGraw Hill Education Pvt. Ltd Publication.
3. R. Lafore, “Object Oriented Programming C++”
4. Herbert Schildt, “C++ The Complete Reference” –Tata McGraw Hill Education Pvt. Ltd. Publication
5. R. Subburaj, “Object Oriented Programming With C++”, Vikas Publishing house, New Delhi
6. Ashok N. Kamthane, “Object Oriented Prgramming with ANSI & Turbo C++”, Pearson Education Publication

PART-B

PRACTICAL / LAB WORK

List of Practicals

- Calculate the Sum of the series $1/1 + 1/2 + 1/3 \dots \dots \dots + 1/N$ for any positive integer N .
- Write a user defined function to find the absolute value of an integer and use it to evaluate the function $\frac{(-1)^n}{|n|}$, for $n = -2, -1, 0, 1, 2$.
- Calculate the factorial of any natural number.
- Read floating numbers and compute two averages: the average of negative numbers and the average of positive numbers.
- Write a program that prompts the user to input a positive integer. It should then output a message indicating whether the number is a prime number.
- Write a program that prompts the user to input the value of a, b and c involved in the equation $ax^2 + bx + c = 0$ and outputs the type of the roots of the equation. Also the program should outputs all the roots of the equation.
- write a program that generates random integer between 0 and 99. Given that first two Fibonacci numbers are 0 and 1, generate all Fibonacci numbers less than or equal to generated number.
- Write a program that does the following:
- Prompts the user to input five decimal numbers.
- Prints the five decimal numbers.
- Converts each decimal number to the nearest integer.
- Adds these five integers.
- Prints the sum and average of them.
- Write a program that uses **while** loops to perform the following steps:
- Prompt the user to input two integers :firstNum and secondNum (firstNum should be less than secondNum).
- Output all odd and even numbers between firstNum and secondNum.
- Output the sum of all even numbers between firstNum and secondNum.
- Output the sum of the square of the odd numbers firstNum and secondNum.
- Output all uppercase letters corresponding to the numbers between firstNum and second-Num, if any.
- Write a program that prompts the user to input five decimal numbers. The program should then add the five decimal numbers, convert the sum to the nearest integer, and print the result.
- Write a program that prompts the user to enter the lengths of three sides of a triangle and then outputs a message indicating whether the triangle is a right triangle or a scalene triangle.
- Write a value returning function **smaller** to determine the smallest number from a set of numbers. Use this function to determine the smallest number from a set of 10 numbers.
- Write a function that takes as a parameter an integer (as a **long** value) and returns the number of odd, even, and zero digits. Also write a program to test your function.
- Enter 100 integers into an array and sort them in an ascending/ descending order and print the largest/ smallest integers.
- Enter 10 integers into an array and then search for a particular integer in the array.
- Multiplication/ Addition of two matrices using two dimensional arrays.

27. Using arrays, read the vectors of the following type: $A = (1\ 2\ 3\ 4\ 5\ 6\ 7\ 8)$,
28. $B = (0\ 2\ 3\ 4\ 0\ 1\ 5\ 6)$ and compute the product and addition of these vectors.
29. Read from a text file and write to a text file.
30. Write a program to create the following grid using for loops:

| | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 2 | 3 | 4 | 5 | 6 |
| 3 | 4 | 5 | 6 | 7 |
| 4 | 5 | 6 | 7 | 8 |
| 5 | 6 | 7 | 8 | 9 |

Course code: MAT-254

COURSE TITLE: Modeling and Simulation

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Marks distribution (Theory):

Internal exam : 10 marks (CIA)
 Short test/quiz : 10 marks (CIA)
 Assignment/activity/minor project : 10 marks (CIA)
 End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)
 Lab Record/note book : 5 marks (CIA)
 End semester exam : 35 marks

PART-A**THEORY****UNIT-1**

What is Mathematical Modeling? History of Mathematical Modeling, latest development in Mathematical Modeling, Merits and Demerits of Mathematical Modeling.

UNIT-2

Introduction to difference equations, Non-linear Difference equations, Steady state solution and linear stability analysis. Introduction to Discrete Models, Linear Models, Growth models, Decay models, Newton's Law of Cooling, Bank Account Problem and mortgage problem, Drug Delivery Problem, Harrod Model of Economic growth, War Model, Lake pollution model, Alcohol in the bloodstream model, Arm Race models, Linear Prey-Predator models, Density dependent growth models with harvesting, Numerical solution of the models and its graphical representation using EXCEL.

UNIT-3

Introduction to Continuous Models, Carbon Dating, Drug Distribution in the Body, Growth and decay of current in a L-R Circuit, Horizontal Oscillations, Vertical Oscillations, Damped Force Oscillation, Dynamics of Rowing, Combat Models, Mathematical Model of Influenza Infection(within host), Epidemic Models (SI, SIR, SIRS, SIC), Spreading of rumour model, Steady States solutions,

Unit-4

Linearization and Local Stability Analysis, logistic and gomperzian growth, prey predator model, Competition models, Numerical solution of the models and its graphical representation using EXCEL.

UNIT-5

Fluid flow through a porous medium, heat flow through a small thin rod (one dimensional), Wave equation, Vibrating string, Traffic flow, Theory of Car-following, Crime Model, Linear stability Analysis: one and two species models with diffusion, Conditions for diffusive instability with examples.

Books Recommended

1. B. Albright, *Mathematical Modeling with Excel*, Jones and Bartlett Publishers, 2010.
2. F.R. Marotto, *Introduction to Mathematical Modeling using Discrete Dynamical Systems*, Thomson Brooks/Cole, 2006.

3. J.N. Kapur, *Mathematical Modeling*, New Age International, 2005.
4. B. Barnes and G. R. Fulford, *Mathematical Modelling with Case Studies*, CRC Press, Taylor and Francis Group, 2009.
5. L. Edsberg, *Introduction to Computation and Modeling for Differential Equations*, John Wiley and Sons.

PART-B

PRACTICAL / LAB WORK

List of Practicals (using MATLAB/MATHEMATICA/MAPLE)

1. Solve the Lanchester combat model

$$\frac{dx}{dt} = 2 - x - 2y$$

$$\frac{dy}{dt} = 1 - .2y - .2xy$$

For a conventional force x versus a guerrilla force, y , on the interval $[0, 5]$ for the initial conditions (a) $x(0) = 0, y(0) = 0$ and (b) $x(0) = 4, y(0) = 1$. In each case, decide which force wins the battle, when victory occurs, and the number of combatants in the winning force at the time of victory.

2. Use computer software to solve the Lanchester combat model

$$\frac{dx}{dt} = 2 - .5x - .5xy$$

$$\frac{dy}{dt} = 1 - .2y - .25xy$$

3. For two guerrilla forces engaged in battle on the interval $[0, 5]$ for the initial conditions:

$$x(0) = 0, y(0) = 0 \quad (b) \quad x(0) = 0, y(0) = 6$$

$$x(0) = 5, y(0) = 0 \quad (d) \quad x(0) = 5, y(0) = 6$$

In each case, display a phase-plane graph of y versus x . Do you think either force will ever win?

4. Use computer software to solve the internal prey and internal predator competition with harvesting model,

$$\frac{dx}{dt} = rx - Cx^2 - Hxy - h_1x$$

$$\frac{dy}{dt} = -sy - Py^2 + Qxy - h_2y$$

Where r, C, H, h_1, s, P, Q and h_2 are all non-negative constants with initial

conditions $x(0) = 3, y(0) = 2$

On the interval $[0, 5]$ for $r = 3, C = 2, H = s = P = Q = 1$, and following five values for the harvesting coefficients:

$$h_1 = h_2 = 0$$

$$h_1 = 1, h_2 = 0$$

$$h_1 = 0, h_2 = 1$$

$$h_1 = 5 = h_2$$

$$h_1 = .25 = h_2$$

4. Use computer software to solve the following epidemic with inoculation model

$$\frac{dS}{dt} = -.01SI - .05SI$$

$$\frac{dI}{dt} = .01SI - 3I$$

$$\frac{dR}{dt} = 3I + .05SI$$

On the interval $[0, 5]$ where t is in days for the initial conditions:

$$S_0 = 300, I_0 = 10, R_0 = 0$$

$$S_0 = 500, I_0 = 10, R_0 = 0$$

Display a graph with S, I and R . Does an epidemic occur in case (b)? In each case,

what is $\lim_{t \rightarrow \infty} S(t)$?

5. Growth model (exponential case only).
6. Decay model (exponential case only).
7. Oxygen debt model.
8. Economic model.
9. Vibration problems.
10. Lake pollution model (with constant/seasonal flow and pollution concentration)
11. Drug assimilation into the blood (Case of single cold pill and a course of cold pills)
12. Limited growth of population (with and without harvesting).

Books Recommended:

1. **C. H. Edwards** and **D. E. Penny**, *Differential Equations and Boundary Value Problems: Computing and Modeling*, Pearson Education, India, 2005.
2. **Belinda Barnes** and **Glenn R. Fulford**, *Mathematical Modeling with Case Studies, A Differential Equation Approach Using Maple*, Taylor and Francis, London and New York, 2002.
3. **S. L. Ross**, *Differential Equations*, John Wiley and Sons, India, 2004.
4. **G. Dennis Zill**, *A First Course in Differential Equations with Modelling Applications*, Cengage Learning India Pvt. Ltd.
5. **J. Sinha Roy** and **S. Padhy**, *A Course of Ordinary and Partial Differential Equations*, Kalyani publishers, New Delhi

Course code: MAT-255

COURSE TITLE: Integral Transforms

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)

Lab Record/note book : 5 marks (CIA)

End semester exam : 35 marks

PART-A**THEORY****UNIT-1**

Laplace transform: Definition and its properties. Rules of manipulations, Laplace theorems of derivatives and integrals, Properties of inverse laplace transtoms, Convolution theorem, Complex inversion formulas.

UNIT-2

Applications of Laplace transform to the solutions of ordinary differential equations with constant and variable coefficients and simple boundary value problems

UNIT-3

Fourier Transform: Definition and properties of fourier sine and cosine and complex transforms, Convolution theorem, Inversion theorems and Fouries transform of derivations

UNIT-4

Applications of Fourier transforms to the solutions of partial differential equations. Mellin Trans form: Definition and elementary properties, Mellin transforms of derivations and integrals Inversion theorem and convolution theorem

UNIT-5

Infinite Hankel transform: Definition and Elementary Properties, Hankel transform of derivations, Inversion theorem and parseval theorem. Application to the Solution of simple boundary value problems.

Books Recommended:E. Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 2011.R.K. Jain and S.R.K. Iyenger, *Advanced Engineering Mathematics*, Narosa Publishing House,2009.F. B. Hildebrand, *Methods of Applied Mathematics*, Courier Dover Publications, 1992.L. Debanth and D. Bhatta, *Integral Transforms and Their Applications*, 2nd Ed., Taylor and Francis Group, 2007.

E.D. Ranville, Laplace and Fourier Transforms

I.N. Sneddon, The use of Integral Transforms

S.P.Goyal, &A.K. Goyal, Integral Transforms

A.H. Ze manian , Generalized Integral transforms.

PART-B**PRACTICALS**

(Mathematics practical with free and open source software (FOSS) tools for computer programs (4hours/ week per batch of not more than 15 students)

1. To plot periodic functions with period 2π and $2L$.
2. To find full range trigonometric Fourier series of some simple functions with period 2π and $2L$.
3. Plotting of functions in half-range and including their even and odd extensions.
4. To find the half-range sine and cosine series of simple functions.
5. Finding the Laplace transforms of some standard functions.
6. Finding the inverse Laplace transform of simple functions.
7. Implementing Laplace transform method of solving ordinary linear differential equations of first and second order with constant coefficient.
8. To find the inverse \mathcal{Z} -transform of the given functions by calculating the partial fractions.
9. To find the inverse Laplace transform of the given functions for rational polynomials.

Note: The above list may be changed annually with the approval of the BUGS in UG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima/MATLAB

Course code: MAT-261

COURSE TITLE: Bio-Mathematics

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)
 Short test/quiz : 10 marks (CIA)
 Assignment/activity/minor project : 10 marks (CIA)
 End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)
 Lab Record/note book : 5 marks (CIA)
 End semester exam : 35 marks

PART-A**THEORY****UNIT-1**

Mathematical Biology and the modelling process: an overview. Continuous models: Malthus model, logistic growth, Allee effect, Gompertz growth, Michaelis-Menten Kinetics, Holling type growth, Bacterial growth in a Chemostat, Harvesting a single natural population

UNIT-2

Epidemic Models (SI, SIR, SIRS, SIC), Activator-Inhibitor system, Insect Outbreak Model: Spruce Budworm, Numerical solution of the models and its graphical representation. Qualitative analysis of continuous models: Steady state solutions, stability and linearization, multiple species communities and Routh-Hurwitz Criteria, Phase plane methods and qualitative solutions, bifurcations and limit cycles with examples in the context of biological scenario.

UNIT-3

Spatial Models: One species model with diffusion, Two species model with diffusion, Conditions for diffusive instability, Spreading colonies of microorganisms, Blood flow in circulatory system, Travelling wave solutions, Spread of genes in a population. Discrete Models: Overview of difference equations, steady state solution and linear stability analysis

UNIT-4

Introduction to Discrete Models, Linear Models, Growth models, Decay models, Drug Delivery Problem, Discrete Prey-Predator models, Density dependent growth models with harvesting, Host-Parasitoid systems (Nicholson-Bailey model), Numerical solution of the models and its graphical representation. Case Studies: Optimal Exploitation models, Models in Genetics, Stage Structure Models, Age Structure Models

UNIT-5

Models for blood flows: some basic concepts for fluid dynamics, basic concepts about blood, cardiovascular system and blood flow, steady non-Newtonian fluid flow in circular tubes, Newtonian pulsatile flows in rigid and elastic tubes, blood flow through artery with mild stenosis, peristaltic flow in tubes and channels, model for air flow in lungs, Diffusion and Diffusion-reaction models, the diffusion equations, oxygen diffusion living tissues.

Books Recommended

1. M. Kot, *Elements of Mathematical Ecology*, Cambridge University Press, 2001.
2. D. S. Jones and B. D. Sleeman, *Differential Equations and Mathematical Biology*, Chapman & Hall, CRC Press, London, UK, 2003.
3. J.D., Murray, *Mathematical Biology*, Springer, 1993.
4. Y.C. Fung, *Biomechanics*, Springer-Verlag, 1990.
5. F. Brauer, P.V.D. Driessche, and J. Wu, *Mathematical Epidemiology*, Springer, 2008.
6. J.N.Kapur, *Mathematical Modelling in Biology and Medicine*, New age international Ltd., Delhi.
7. James Keener and James Sneyd, *Mathematical Physiology*, Springer Verlag, 1998, Corrected 2nd printing, 2001

PART-B**PART-B****PRACTICAL**

Modeling of the following problems using any Free and open Source Software(FOSS) OR MATLAB/Mathematica/ Maple.

1. Predator-prey model (basic volterra model, with density dependence, effect of DDT, two prey one predator).
2. Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers).

3. (computer simulation) Use a computer to iterate numerically the equation

$$N_{k+1} = N_k e^{a(1 - \frac{N_k}{k})}$$

Where k is the carrying capacity and $a > 0$ is a constant. You are given

$$k = 1000, N_0 = 100$$

and you should use your own choice of values of a . Describe the types of behavior which appear for different values of a .

In particular: (a) When do 2-cycles first appear?

(b) When do 2-cycles becomes 4-cycles?

(c) Does the model exhibit chaos?

4. A model which has been used to analyse insect populations is given by the difference equation

$$N_{k+1} = \frac{\lambda N_k}{(1 + N_k)^b}$$

for the insect population N_k . Using a computer, sketch solutions for the following values of the parameters:

| | λ | b |
|---------------|-----------|-----|
| Moth | 1.3 | 0.1 |
| Mosquito | 10.6 | 1.9 |
| Potato Beetle | 75.0 | 3.4 |

5. For the discrete logistic equation with $K = 1000$, examine N_{100} as you vary N_0 slightly in each of the following cases: (a) $r = 0.5$

(b) $r = 2.5$

(c) $r = 3$

Course code: MAT-262**COURSE TITLE: Linear Programming**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory + Tutorial)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)
 Short test/quiz : 10 marks (CIA)
 Assignment/activity/minor project : 10 marks (CIA)
 End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)
 Lab Record/note book : 5 marks (CIA)
 End semester exam : 35 marks

PART-A**THEORY****UNIT-1**

Introduction to linear programming problem, Graphical Approach for Solving some Linear Programs. Convex Sets, Supporting and Separating Hyperplanes. Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method, Big-M method and their comparison.

UNIT-2

Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual.

UNIT-3

Transportation problem and its mathematical formulation, northwest-corner method (NWCM) least cost method(LCM) and Vogel approximation method(VAM) for determination of starting basic solution.

UNIT-4

Algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem, Optimum solution of TP by Modi method (u-v method) (except degenerate solution),

UNIT-5

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure, linear programming solution of games.

Books Recommended:

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear Programming and Network Flows*, 2nd Ed., John Wiley and Sons, India, 2004.
2. F.S. Hillier and G.J. Lieberman, *Introduction to Operations Research*, 9th Ed., Tata McGraw Hill, Singapore, 2009.
3. Hamdy A. Taha, *Operations Research, An Introduction*, 8th Ed., Prentice-Hall India, 2006.
4. G. Hadley, *Linear Programming*, Narosa Publishing House, New Delhi, 2002.

PART-B**PRACTICAL****List of Practicals**

1. Solve the given LPP using Graphical method.
2. Solve the given LPP using Simplex method.
3. Solve the given LPP using BIG -M method.
4. Solve the given LPP using TWO-PHASE method.
5. Obtain DUAL of the given Primal LPP;
6. Find the initial solution of given transportation problem using NWCM method.
7. Find the optimum solution of given transportation problem using LCM method.
8. Find the optimum solution of given transportation problem using VAM method.
9. Find the optimum solution of given transportation problem using MODI method.
10. Find the optimum solution of given assignment problem.

Notes

- There shall be **TWO** periods of **TWO hour** per week per batch of **15** students.
- practical should be done during semester-VI in allotted time.
- At the time of examination candidate must bring his/her own practical journal duly certified and signed by **H.O.D.**
- There shall be one question paper of **35 Marks** for **3 Hours** in practical examination
- There shall be **10 marks** for Internal Practical Examination
(i.e. Continuous internal assessment of performance of each student during the practical work.)

Format of Question Paper for Practical Examination

| | | | |
|--------------|--------------------------------|--------------|-----------------|
| Question 1 | Answer any TWO out of FIVE | [17.5+17.5= | 35 Marks |
| Question 2 | Journal and Viva: | [| 5 Marks |
| Question 3: | Internal Practical Examination | [| 10 Marks |
| TOTAL | | [| 50 Marks |

Course code: MAT-263

COURSE TITLE: Applications of Algebra

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Total marks: 100 (Theory + Tutorial)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

THEORY

UNIT-1

Balanced incomplete block designs (BIBD): definitions and results, incidence matrix of a BIBD, construction of BIBD from difference sets, construction of BIBD using quadratic residues, difference set families, construction of BIBD from finite fields.

UNIT-2

Coding Theory: introduction to error correcting codes, linear codes, generator and parity check matrices, minimum distance, Hamming Codes, decoding and cyclic codes.

UNIT-3

Symmetry groups and color patterns: review of permutation groups, groups of symmetry and action of a group on a set; colouring and colouring patterns, Polya theorem and pattern inventory, generating functions for non-isomorphic graphs

UNIT-4

Application of linear transformations: Fibonacci numbers, incidence models, and differential equations. Least squares methods: Approximate solutions of system of linear equations, approximate inverse of an $m \times n$ matrix, solving a matrix equation using its normal equation, finding functions that approximate data.

UNIT-5

Linear algorithms: LDU factorization, the row reduction algorithm and its inverse, backward and forward substitution, approximate substitution, approximate inverse and projection algorithms.

Reference:

1. I.N. Herstein and D.J. Winter, *Primer on Linear Algebra*, Macmillan Publishing Company, New York, 1990.
2. S.R. Nagpaul and S.K. Jain, *Topics in Applied Abstract Algebra*, Thomson Brooks and Cole, Belmont, 2005

TUTORIAL

Problem solving session

Course code: MAT-264

COURSE TITLE: Fluid Dynamics

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Total marks: 100 (Theory + Tutorial)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

THEORY**UNIT-1**

Kinematics of fluids in motion: Real fluids and ideal fluids – velocity of a fluid at a point – stream lines and path lines; steady and unsteady flows – the velocity potential – the vorticity vector – local and particle rates of change – the Equations of continuity – worked examples – Acceleration of fluid – Conditions at a rigid boundary – general analysis of fluid motion

UNIT-2

Equations of motions of a fluid: Pressure at a point in a fluid at rest – Pressure at a point in moving fluid – Conditions at a boundary of two inviscid immiscible fluids – Euler's equation of motion, Bernoulli's equation – worked examples.

UNIT-3

Some Three Dimensional Flows-Introduction, Sources, sinks and doublets, Axis Symmetric flows, Stokes Stream function

UNIT-4

Some two Dimensional Flows-Meaning of two Dimensional Flows, Use of Cylindrical polar coordinates, The Stream function, The complex potential for two dimensional, irrotational, incompressible flows, Complex velocity potentials for standard two dimensional flows.

UNIT-5

Viscous Flows-Stress components in real fluids, Relation between Cartesian components of stress, Translation motion of a fluid element, The rate of strain quadric and principle stresses, Some Further properties of the rate of strain quadric Stress analysis in fluid motion, Relation between stress and rate of strain, The Coefficient of Viscosity and Laminar flow, The Navier Stokes equations of motion of a viscous fluid.

Books Recommended:

1. **F. Charlton**, A Text Book of Fluid Dynamic, by Published by CBS Publications, New Delhi
2. **P.K.Kundu, I.M.Cohen**, Fluid Mechanics, Fourth Edn, Elsevier.
3. **G.K.Batchelor**, An Introduction of Fluid Mechanics, Foundation Books, New Delhi,1993
4. **R.Von Mises,K,O.Friedrichs**, Fluid Dynamics, Springer International Student Edition, Narosa Publishing House, New Delhi.
1. **A.R.Paterson**, A First Course in Fluid Dynamics, Cambridge University Press, New York,1987
2. **Chia-shun Yeh**, Fluid Mechanics : An Introduction to the theory, (McGraw Hill, 1974)
3. **F.M. White** : Fluids Mechanics, (McGraw Hill, 2003)
4. **R.W. Fox, A.T Mc Donald and P.J. Pritchard** : Introduction to Fluid Mechanics, (John Wiley and Sons. Pvt. Ltd., 2003)

TUTORIAL

Problem solving session

III. GENERIC ELECTIVE COURSE (GEC)

Course code: MAT-311

COURSE TITLE: CALCULUS

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Total Credits : 6 (Theory 4 ; practical 2 credits)

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)

Lab Record/note book : 5 marks (CIA)

End semester exam : 35 marks

THEORY

Objectives

The course introduces students to the fundamental principles, concepts and knowledge in the areas of Differential and Integral Calculus. This prepares the students to apply these fundamental concepts and working knowledge to other courses.

UNIT-I: Differential Calculus

Definition of the limit of a function ($\epsilon - \delta$) form – Continuity – Types of discontinuities – Properties of continuous functions on a closed interval – Differentiability – Differentiability implies continuity – Converse not true – Rolle's theorem – Lagrange's and Cauchy's First Mean Value Theorems – Taylor's theorem (Lagrange's form) – Maclaurin's theorem and expansions – Evaluation of limits by L'Hospital's rule.

UNIT-2 Differential Calculus:

Hyperbolic functions: Identities and its derivatives, Inverse hyperbolic functions- Derivatives; Higher order derivatives- Leibnitz's theorem and its application, Differentiation of homogeneous functions – Euler's theorem – Total derivative and differential – Differentiation of implicit functions and composite functions – Jacobians, maxima and minima functions of 2 & 3 independent variable, Lagrange's method (without proof), problems on this concepts.

UNIT-3 Differential Calculus:

Sub tangent and subnormal – Polar coordinates angle between the tangents -slope of the tangent –Angle of intersection of two curves – polar sub tangent and polar subnormal – Length of arc. Polar coordinates – Angle between radius vector and tangent ; Curvature, Radius of Curvature in Cartesian and Polar coordinates, p-r equation. Evolutes, Asymptotes: Methods of finding asymptotes of rational algebraic curves with special cases.

UNIT-IV: Integral Calculus

Volumes and surfaces of revolution; Reduction formulae, Beta and Gamma Functions - Properties and Problems.

UNIT-V: Integral Calculus

Double Integrals - Change of order of Integration - Triple Integrals - Applications to Area, Surface Area and Volume.

Recommended Text-

1. K.C. Maity, R. Ghosh, Differential Calculus(7th Edition), New Central Book Agency, 2004
2. K.C. Maity, R. Ghosh, Integral Calculus(7th Edition), New Central Book Agency, 2004.
- 3.
4. S.Narayanan and T.K.Manicavachagom Pillay (2004) *Calculus*. S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai
- 5.
6. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
7. H. Anton, I. Bivens and S. Davis, Calculus (7th Edition), John Wiley and sons (Asia), Pt Ltd., Singapore, 2002.
8. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
9. R. Courant and F. John, *Introduction to Calculus and Analysis* (Volumes I & II), Springer-Verlag, New York, Inc., 1989.

PRACTICAL

1. List of practicals(using Scilab/Matlab/ Mathematica/Maple)
2. Practical based on tracing curves (Trigonometric function , Inverse function, Exponential function, Logarithmic function, Hyperbolic function)
3. (a)Draw the graph of $\sin x$, $\cos x$, $\tan x$, $\cot x$, $\sec x$, $\csc x$.
4. (b) Draw the graph of $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$, $\cot^{-1}x$, $\sec^{-1}x$, $\csc^{-1}x$.
5. (c) Draw the graph of $\sinh x$, $\cosh x$, $\tanh x$, $\coth x$.
6. (d) Draw the graph of $\log_a x$ & a^x , $a \in \mathbb{R}^+ - \{1\}$.
7. (e) Draw the graph of cardioids, asteroid.
8. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
9. Practical based on integral and reduction formula, Summation of the series, Rectification, surface & volume.
10. (a)Application of Reduction formula for integration.
11. (b)Summation of series using integration.
12. (c) Application of rectification by using integration.
13. (d) Application of surface revolution using integration.
14. (e) Application of volume revolution.
- 15.
16. Practical based on successive differentiation
17. (a)Find the n^{th} derivative of the given function at given point.
18. (b)Application of Leibnitz theorem.
19. Evaluation of limits by L'Hospital's rule using Scilab/Matlab.
20. Computation of limit, differentiation and integration of different kind of functions.
21. Application of Taylor's and Maclaurin theorems
22. Application of Partial Derivatives

Note: The above list may be changed annually with the approval of the BUGS(Mathematics).

Course code: MAT-321**COURSE TITLE: Differential Equations**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Total Credits : 6 (Theory 4 ; practical 2 credits)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)
 Short test/quiz : 10 marks (CIA)
 Assignment/activity/minor project : 10 marks (CIA)
 End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)
 Lab Record/note book : 5 marks (CIA)
 End semester exam : 35 marks

THEORY**Objectives**

This course aims to provide logical skills in the formation of differential equations, to expose to different techniques of finding solutions to these equations and in addition stress is laid on the application of these equations in geometrical and physical problems.

UNIT-I: Ordinary Linear Differential Equations (12 hours)

Bernoulli Equation – Exact Differential Equations – Equations Reducible to Exact Equations – Equations of First order and Higher degree: General and singular solutions - Equations solvable for p, Equation solvable for x and Equations Solvable for y – Clairaut's Equation.

UNIT-II: Ordinary Linear Differential Equations. (12 hours)

Linear differential equations of higher order with constant coefficients. Operator D, Meaning of auxiliary equation, Roots of auxiliary equation and solution of auxiliary equation

$f(D)y = 0$ for real roots and complex roots, Operator $\frac{1}{D}$. Solution of differential equations of the type $f(D)y = X$. Meaning of complimentary function(C.F.) and Particular integral(P.I.). Methods to obtain Particular integral (P.I.)

when $X = e^{ax}$, $X = \sin(ax + b)$, $X = \cos(ax + b)$, $X = x^m$, $X = e^{ax}V(x)$

Method of Variation of Parameters – 2nd order Differential Equations with Constant Coefficients for finding the P.I's of the form $e^{ax}V(x)$, where V is $\sin mx$, $\cos mx$ and x^n .

UNIT-III: Differential Equations of Other Types . (12 hours)

Equations reducible to non-homogeneous/homogeneous Linear equations with constant coefficients – Cauchy's homogeneous Linear Equations – Legendre's Linear Equations – Linear Dependence of Solutions – Simultaneous Equations with Constant Coefficients.

Equations of form $\frac{d^2y}{dx^2} = f(x)$, Equations of the form $\frac{d^2y}{dx^2} = f(y)$, Equations which do not contain y , Equations which do not contain x , Total Differential Equations Simultaneous Total Differential Equations – Equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$, Method of Grouping.

UNIT-IV: Laplace Transform**(12 hours)**

Transform-Inverse Transform – Properties – Application of Laplace Transform to solution of first and second order Linear Differential equations [with constant coefficients] and simultaneous Linear Differential Equations.

UNIT-V: Partial Differential Equations**(12 hours)**

Formation of PDE – Complete Integral – Particular Integral – Singular Integral – equations Solvable by direct Integration – Linear Equations of the first order – Non-linear Equations of the first Order–Non-linear Equations of the first Order:

Types:

$$f[p, q] = 0, f[x, p, q] = 0, f[y, p, q] = 0, f[z, p, q] = 0, f[x, q] = f[y, p], z = px + qy + f[p, q]$$

Book Recommended:

1. **C. H. Edwards** and **D. E. Penny**, *Differential Equations and Boundary Value Problems: Computing and Modeling*, Pearson Education, India, 2005.
2. **I. Sneddon**, *Elements of Partial Differential Equations*, McGraw Hill.
3. **S. L. Ross**, *Differential Equations*, John Wiley and Sons, India, 2004.
4. **G. Dennis Zill**, *A First Course in Differential Equations with Modelling Applications*, Cengage Learning India Pvt. Ltd.
5. **J. Sinha Roy and S. Padhy**, *A Course of Ordinary and Partial Differential Equations*, Kalyani publishers, New Delhi
6. **M.R.Spiegel**, *Laplace Transforms*, Tata McGraw Hill Edition, New Delhi, 2005
7. **T. Amaranath**, *An Elementary Course in Partial Differential Equations*, 2nd Edn., Narosa Publication House, New Delhi-2013.
8. **Tyn Myint-U and Lokenath Debnath**, *Linear Partial Differential Equations for Scientists and Engineers*, 4th edition, Springer, Indian reprint, 2006.
9. **E.A. Coddington**, *An introduction to Ordinary Differential Equations*, Prentice Hall India.

List of Practicals

1. Application of linear differential equation $\frac{dy}{dx} + Py = Q$, where P and Q are function of x.
2. Application of Bernoulli's differential equation.
3. Application of differential equation in first order and higher degree
4. solvable for x, y and p, where $p = \frac{dy}{dx}$
5. Application of Clairaut's differential equation
6. Application of linear differential equation with constant coefficients.
7. Plotting 2 D curves
8. 3-D plots and plotting of surfaces.
9. Finding the Laplace transforms of some standard functions.
10. Finding the inverse Laplace transform of simple functions.
11. Implementing Laplace transform method of solving ordinary linear differential equations of first and second order with constant coefficient
12. To find the inverse Laplace transform for rational polynomials.

Course code: MAT -331

COURSE TITLE: Multivariate Calculus

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Total Credits : 6 (Theory 4 ; practical 2 credits)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)
 Short test/quiz : 10 marks (CIA)
 Assignment/activity/minor project : 10 marks (CIA)
 End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)
 Lab Record/note book : 5 marks (CIA)
 End semester exam : 35 marks

THEORY**UNIT-1**

Functions of several variables, limit and continuity of functions of two variables Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters, directional derivatives.

Unit-2

The gradient, maximal and normal property of the gradient, tangent planes; Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems.

Unit-3

Definition of vector field, divergence and curl and its related properties.

Unit-4

Double integration over rectangular region, double integration over nonrectangular region. Double integrals in polar co-ordinates, Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical co-ordinates

Unit-5

Line integrals, Applications of line integrals: Mass and Work. Fundamental theorem for line integrals, conservative vector fields, independence of path. Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stokes' theorem, The Divergence theorem.

Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, *Calculus*, 3rd Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
3. E. Marsden, A.J. Tromba and A. Weinstein, *Basic Multivariable Calculus*, Springer (SIE), Indian reprint, 2005.
4. James Stewart, *Multivariable Calculus, Concepts and Contexts*, 2nd Ed., Brooks /Cole, Thomson Learning, USA, 2001.

PRACTICAL***Practical / Lab work to be performed on a computer:***

Modeling of the following problems using *Matlab / Mathematica / Maple* etc.

1. Draw the following surfaces and find level curves at the given heights:
2. Draw the given surfaces and discuss whether limit exists or not as x approaches to the given points. Find the limit, if it exists:
3. Draw the tangent plane to the given surfaces at the given points.
4. Use an incremental approximation to estimate the given functions at the given point and compare it with calculated value.
5. Find critical points and identify relative maxima, relative minima or saddle points to the given surfaces, if it exist:

Course code:MAT-341

COURSE TITLE: Numerical Methods

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Total marks: 150 (Theory+ practical)

Total Credits : 6 (Theory 4 ; practical 2 credits)

Marking system:

Marks distribution (Theory):

Internal exam : 10 marks (CIA)

Short test/quiz : 10 marks (CIA)

Assignment/activity/minor project : 10 marks (CIA)

End semester exam : 70 marks

Practical:

Attendance/lab work : 10 marks (CIA)

Lab Record/note book : 5 marks (CIA)

End semester exam : 35 marks

PART-A**THEORY****UNIT-1**

Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation, Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods

UNIT-2

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis

UNIT-3

Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.

UNIT-4

Numerical Integration: Trapezoidal rule, Simpson's rule, Simpsons 3/8th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule

UNIT-5

Ordinary Differential Equations: Euler's method. Runge-Kutta methods of orders two and four.

PART-B**PRACTICALS**

Use of computer aided software (CAS), for example *Matlab / Mathematica / Maple / Maxima* etc., for developing the following Numerical programs

$$\frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n}$$

1. Calculate the sum
2. To find the absolute value of an integer.
3. Enter 100 integers into an array and sort them in an ascending order
4. Any two of the following
 - (a) Bisection Method
 - (b) Newton Raphson Method
 - (c) Secant Method
 - (d) Regula Falsi Method
5. LU decomposition Method
6. Gauss-Jacobi Method
7. SOR Method or Gauss-Siedel Method
8. Lagrange Interpolation or Newton Interpolation
9. Simpson's rule

NOTE: For any of the CAS *MATLAB / Mathematica / Maple / Maxima* etc., Data types-simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, input/output, relational operators, logical operators and logical expressions, control statements and loop statements, Arrays should be introduced to the students.

Books Recommended:

1. Richard L. Faires, J. Douglas Burden, Numerical Analysis, 8th Edn, Brookes Cole, USA.
2. Brian Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007
3. Cesar Pérez López, MATLAB Programming for Numerical Analysis, springer-USA
4. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 6th Ed., New age International Publisher, India, 2007.
5. C.F. Gerald and P.O. Wheatley, *Applied Numerical Analysis*, Pearson Education, India, 2008.
6. Uri M. Ascher and Chen Greif, *A First Course in Numerical Methods*, 7th Ed., PHI Learning Private Limited, 2013
7. John H. Mathews and Kurtis D. Fink, *Numerical Methods using Matlab*, 4th Ed., PHI Learning Private Limited, 2012

IV. SKILL ENHANCEMENT COURSE (SEC)

Course code: MAT-531

COURSE TITLE: LaTeX and HTML

| | | | |
|----------------|-------|-------|-------|
| Credit : 2 | L - 1 | P - 1 | T - 0 |
| Marks (CIA:ES) | 0:30 | 20:0 | - |

Marks distribution:

Assignment/activity/minor project : 20 marks

End semester exam : 30 marks

Exam duration: 2 hours

PART-A**THEORY****UNIT-1**

Elements of LaTeX; Hands-on-training of LaTeX; Graphics in LaTeX; PSTricks; Beamer presentation;

UNIT-2

HTML, creating simple web pages, images and links

UNIT-3

Design of web pages using HTML

PART-B**PRACTICALS**

Six practicals should be done by each student. The teacher can assign practical from the exercises from [1].

References:

1. Martin J. Erickson and Donald Bindner, A Student's Guide to the Study, Practice, and Tools of Modern Mathematics, CRC Press, Boca Raton, FL, 2011.
2. L. Lamport, LATEX: A Document Preparation System, User's Guide and Reference Manual. Addison-Wesley, New York, second edition, 1994.

Course code: MAT-532**COURSE TITLE: Graph Theory**Marks distribution :

Assignment/activity/minor project : 20

End semester exam : 30 marks

Tutorial: Nil

| | | | |
|-----------------------|---------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20: 30 | - | - |

UNIT-1

Definition, examples and basic properties of graphs, pseudographs, complete graphs, bi-partite graphs, isomorphism of graphs.

UNIT-2

Eulerian circuits, Eulerian graph, semi-Eulerian graph and related theorems, Hamiltonian cycles and related theorems.

UNIT-3

The adjacency matrix, weighted graph, travelling salesman's problem, shortest path, Dijkstra's algorithm, Floyd-Warshall algorithm

Books Recommended:

1. Edgar G. Goodaire and Michael M. Parmenter, *Discrete Mathematics with Graph Theory* 2nd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2003.
2. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Course code: MAT-533**COURSE TITLE: Logic and Sets**Marks distribution:

Assignment/activity/minor project : 20 marks

End semester exam : 30 marks

Tutorial: Nil

| | | | |
|-----------------------|---------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20: 30 | - | - |

UNIT-1

Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

UNIT-2

Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set. Countability of a set.

UNIT-3

Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, partial ordering relation, n-ary relations, lattices.

Books Recommended:

1. R.P. Grimaldi, *Discrete Mathematics and Combinatorial Mathematics*, Pearson Education, 1998.
2. P.R. Halmos, *Naive Set Theory*, Springer, 1974.
3. E. Kamke, *Theory of Sets*, Dover Publishers, 1950.

Course code: MAT-541

COURSE TITLE: Computer Algebra Systems and Related Softwares

Marks distribution:

Assignment/activity/minor project : 20 marks

End semester exam : 30 marks

Time duration: 2 hours

| Credit : 2 | L - 1 | P - 1 | T - 0 |
|----------------|-------|-------|-------|
| Marks (CIA:ES) | 0:30 | 20:0 | - |

PART-A

THEORY

UNIT-1

Use of Mathematica, Maple, and Maxima as calculator, in computing functions, in making graphs;

UNIT-2

MATLAB/Octave for exploring linear algebra and to plot curve and surfaces.

UNIT-3

the statistical software R: R as a calculator, explore data and relations, testing hypotheses, generate table values and simulate data, plotting

PART-B

PRACTICALS

Six practical should be done by each student. The teacher can assign practical from the exercises from [1].

References:

1. Martin J. Erickson and Donald Bindner, A Student's Guide to the Study, Practice, and Tools of Modern Mathematics, CRC Press, Boca Raton, FL, 2011.

Course code: MAT-542

COURSE TITLE: Transportation and Game Theory

| | | | |
|----------------|--------|-------|-------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20: 30 | - | - |

Marks distribution:

Assignment/activity/minor project : 20 marks

End semester exam : 30 marks

Tutorial: Nil

UNIT-1

Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem.

UNIT-2

Assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

UNIT-3

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure.

Books Recommended:

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear Programming and Network Flows*, 2nd Ed., John Wiley and Sons, India, 2004.
2. F. S. Hillier and G. J. Lieberman, *Introduction to Operations Research*, 9th Ed., Tata McGraw Hill, Singapore, 2009
3. Hamdy A. Taha, *Operations Research, An Introduction*, 8th Ed., Prentice-Hall India, 2006.

The Scheme of examination for CBCS Course in Mathematics**Scheme of Examination (Theory)**

The performances of the learners shall be evaluated into two parts. The learners performance shall be assessed by Continuous Internal Assessment(CIA) with 30% marks in the first part by conducting the semester End Examinations with 70% marks in the second part. The allocation of the marks for the Internal assessment and semester End Examinations are as shown below-

(a) CIA -30%

| Serial No. | Evaluation Type | Marks |
|------------|------------------|-------|
| 1 | Assignments | 10 |
| 2 | One class test | 10 |
| 3 | Short test/ Quiz | 10 |

(b) External Theory Examinations- 70%

- Duration-These examinations shall be of 3 hours duration.
- Theory question paper pattern :-
 - There shall be total 10 questions (each of 14 marks) with 2 questions from each unit.
 - All questions shall be compulsory with internal choice within the question.
 - Each question may be subdivided into sub-questions a, b, c and the allocation the marks depends on the weighted of the topic.
 - Each question will be of 14 when marks of all the sub questions are added (including the

| Questions | Unit no. | Marks |
|------------------|-----------------|-----------|
| Q1/Q2 | Based on unit-1 | 14 |
| Q3/Q4 | Unit-2 | 14 |
| Q5/Q6 | Unit-3 | 14 |
| Q7/Q8 | Unit-4 | 14 |
| Q9/Q10 | Unit-5 | 14 |
| Total marks = 70 | | |
| Total questions= | 10 | Credit= 4 |

options) in that question.

Semester End Examination practicals-(credit-2)

At the end of the semester examination of 3 hours duration and 35 marks shall be held for each course as given below-

Semester End Examination practicals-(credit-2)

At the end of the semester examination of 3 hours duration and 35 marks shall be held for each course as given below-

| Practical Course | Total no. of questions | Maxm. No. of questions to attempt | Marks out of | Duration |
|--------------------|------------------------|-----------------------------------|--------------|----------|
| MAT-111 | 5 | 2 | 35 | 3 hours |
| MAT-112 | 5 | 2 | 35 | 3 hours |
| MAT-122 | 5 | 2 | 35 | 3 hours |
| MAT-133 | 5 | 2 | 35 | 3 hours |
| MAT-141 | 5 | 2 | 35 | 3 hours |
| MAT-151 | 5 | 2 | 35 | 3 hours |
| MAT-162 | 5 | 2 | 35 | 3 hours |
| MAT-251,Option-3 | 5 | 2 | 35 | 3 hours |
| MAT-252,Option-1,2 | 5 | 2 | 35 | 3 hours |
| MAT-261 Option-1,2 | 5 | 2 | 35 | 3 hours |
| MAT-311 | 5 | 2 | 35 | 3 hours |
| MAT-321 | 5 | 2 | 35 | 3 hours |
| MAT-331 | 5 | 2 | 35 | 3 hours |
| MAT-341 | 5 | 2 | 35 | 3 hours |
| MAT-531 Option-1 | | | | |
| MAT-541 Option-1 | | | | |

CIA Practicals

Attendance/Lab work- 10 marks

Lab records/ note book- 5 marks

B.SC PHYSICS

| | CORE COURSE | Ability Enhancement Course | Skill Enhancement Course | Elective Discipline Specific Course | Elective: Generic Course (To be taken from other discipline) |
|-------------------------|--|----------------------------|--|--|--|
| I | PHY 111 Mathematical Physics-I | English Communication | | | GE-1 (PHY 311) Mechanics |
| | PHY 112 Mechanics | | | | |
| II | PHY 121 Electricity and Magnetism | Environmental Studies | | | GE-2 (PHY 321) Electricity and Magnetism |
| | PHY 122 Waves and Optics | | | | |
| III | PHY 131 Mathematical Physics- II | | PHY 531 Electrical Circuit and Network | | GE-3 (PHY 331) Thermal Physics and Statistical Me- chanics |
| | PHY 132 Thermal Physics | | | | |
| | PHY 133 Digital Systems and Applications | | | | |
| IV | PHY 141 Mathematical Physics III | | PHY 541 Electronic Instrumentation | | GE-4 (PHY 341) Elements of Modern Physics |
| | PHY 142 Elements of Modern Physics | | | | |
| | PHY 143 Analog Systems and Applications | | | | |
| V | PHY 151 Quantum Mechanics | | | PHY 251 Classical Mechanics | |
| | PHY 152 Solid State Physics | | | PHY 252 Medical Physics | |
| VI | PHY 161 Electromagnetic Theory | | | PHY 261 Physics of Earth | |
| | PHY 162 Statistical Mechanics | | | PHY 262 Nuclear and Particle Physics | |
| No. of Courses (Credit) | 14 (84) | 2 (4) | 2 (4) | 4 (24) | 4 (24) |

I. CORE COURSE (CC)

Course Code: PHY 111

Course Title: MATHEMATICAL PHYSICS-I

Lectures: 60

Full Marks = 100 [End Semester Exam (70) Internal Assessment (30)]

Pass Marks = 40 [End Semester Exam (28)]

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Calculus-I:

Recapitulation: Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only). First Order Differential Equations and Integrating Factor. Second Order differential equations: Homogeneous Equations with constant coefficients **(12 Lectures)**

Unit 2: Calculus-II:

Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems. Particular Integral. Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers. **(12 Lectures)**

Unit 3: Vector Calculus I:

Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields. **(5 Lectures)**

Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities. **(7 Lectures)**

Unit 4: Vector Calculus II:

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs). **(12 Lectures)**

Unit 5: Orthogonal Curvilinear Coordinates and Dirac Delta function:

Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. **(8 Lectures)**

Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function. **(4 Lectures)**

Reference Books:

- Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edition, Elsevier.
- An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning
- Differential Equations, George F. Simmons, 2007, McGraw Hill.
- Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
- Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
- Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning
- Mathematical Physics, Goswami, 1st edition, Cengage Learning
- Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press
- Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
- Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Press

PHY(L) 111 LAB: MATHEMATICAL PHYSICS-I**Contact Hours: 60****Full Marks = 50** [End Semester Exam (35) Internal Assessment (15)]**Pass Mark = 20** [End Semester Exam (14)]

The aim of this Lab is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- *Highlights the use of computational methods to solve physical problems*
- *The course will consist of lectures (both theory and practical) in the Lab*
- *Evaluation done not on the programming but on the basis of formulating the problem*
- *Aim at teaching students to construct the computational problem to be solved*
- *Students can use any one operating system Linux or Microsoft Windows*

| | |
|---|---|
| Basics of scientific computing | Binary and decimal arithmetic, Floating point numbers, |
| Topics | Description with Applications |
| Introduction and Overview | Computer architecture and organization, memory and Input/output devices |
| | algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow & overflow-emphasize the importance of making equations in terms of dimensionless variables, Iterative methods |
| Errors and error Analysis | Truncation and round off errors, Absolute and relative Errors, Floating point computations. |
| Review of C & C++ /FORTRAN Programming Fundamentals | Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data looping statements) (<i>If statement. If else Statement. Nested if Structure.Else-if Statement. Ternary Operator. Goto Statement. Switch Statement. Else if Statement. Ternary Operator. Conditional Looping. While Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops</i>), Arrays (<i>1D & 2D</i>) and strings, user defined functions, Structures and Unions, Idea of classes and objects |

| | |
|--|--|
| Programs: | Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Maximum minimum and range of numbers, addition, multiplication and inverse of matrix, solution of quadratic equation, solution of simultaneous equation, values of sine, cosine and exponential function using their series expansion |
| Random number generation | Area of circle, area of square, volume of sphere, value of pi (π) |
| Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson, Simpson Rule and Secant methods | $\alpha = \tan \alpha; I = I_0 (1 - \sin \alpha / \alpha)^2$ in optics |
| Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation | Evaluation of trigonometric functions e.g. $\sin \theta, \cos \theta, \tan \theta, etc.$ |
| Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method | Given Position with equidistant time data to calculate Velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop |
| First order differential equation Radioactive decay Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods | Radioactive decay Current in RC, LC circuits with DC source Newton's law of cooling Classical equations of motion Attempt following problems using RK 4 order method: |

Referred Books:

- Introduction to Numerical Analysis, S.S. Sastry, 5th Edn. , 2012, PHI Learning Pvt. Ltd.
- Schaum's Outline of Programming with C++. J. Hubbard, 2000, McGraw-Hill Pub.
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Press et al., 3rd Edn. , 2007, Cambridge University Press.
- A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning.
- Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn. , 2007, Wiley India Edition.
- Numerical Methods for Scientists & Engineers, R.W. Hamming, 1973, Courier Dover Pub.
- An Introduction to computational Physics, T.Pang, 2nd Edn. , 2006, Cambridge Univ. Press
- Computational Physics, Darren Walker, 1st Edn., 2015, Scientific International Pvt. Ltd.

Course Code: PHY 112
Course Title: MECHANICS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures: 60

Full Marks = 100 [End Semester Exam (70) Internal Assessment (30)]

Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Fundamentals of Dynamics:

Reference frames. Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Momentum of variable-mass system: motion of rocket. Motion of a projectile in Uniform gravitational field Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse.
(5 Lectures)

Work and Energy: Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy.
(5 Lectures)

Collisions: Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames.
(2 Lectures)

Unit 2: Rotational Dynamics:

Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation.
(8 Lectures)

Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or Wire.
(2 Lectures)

Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube.
(2 Lectures)

Unit 3: Gravitation and Central Force Motion:

Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere.
(4 Lectures)

Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).
(8 Lectures)

Unit 4: Oscillations:

SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor.

Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems. **(4 Lectures)**

Unit 5: Special Theory of Relativity:

Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of Energy and Momentum. Energy-Momentum four vectors.

(12 Lectures)

Reference Books:

- An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
- Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
- Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
- Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.
- Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
- Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Additional Books for Reference

- Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
- University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley
- Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serway, 2010, Cengage Learning
- Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.

PHY(L) 112-LAB: MECHANICS

Contact Hours: 60

Full Marks = 50 [End Semester Exam (35) Internal Assessment (15)]

Pass Mark = 20 [End Semester Exam (14)]

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To determine the height of a building using a Sextant.
4. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
5. To determine the Moment of Inertia.
6. To determine g and velocity for a freely falling body using Digital Timing Technique
7. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
8. To determine the Young's Modulus of a Wire.
9. To determine the Modulus of Rigidity .
10. To determine the elastic Constants of a wire by Searle's method.
11. To determine the value of g using Bar Pendulum.
12. To determine the value of g using Kater's Pendulum.

Reference Books

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, re printed 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal
- Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
- Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.

Course Code: PHY 121

Course Title: ELECTRICITY AND MAGNETISM

Contact Hours: 60

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Unit 1: Electric Field and Electric Potential:

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry.

(6 Lectures)

Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole.

(6 Lectures)

Unit 2:

Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere.

(10 Lectures)

Dielectric Properties of Matter: Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector \mathbf{D} . Relations between \mathbf{E} , \mathbf{P} and \mathbf{D} . Gauss' Law in dielectrics.

(5 Lectures)

Unit 3: Magnetic Field:

Magnetic force between current elements and definition of Magnetic Field \mathbf{B} . Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of \mathbf{B} : curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field.

(12 Lectures)

Unit 4: Magnetic Properties of Matter:

Magnetization vector (**M**). Magnetic Intensity (**H**). Magnetic Susceptibility and permeability. Relation between **B**, **H**, **M**. Ferromagnetism. B-H curve and hysteresis.

(3 Lectures)

Electromagnetic Induction: Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current.

(6 Lectures)**Unit 5: Electrical Circuits:**

AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit.

(5 Lectures)

Network theorems: Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits.

(4 Lectures)

Ballistic Galvanometer: Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping. CDR.

(3 Lectures)**Reference Books:**

- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
- Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
- Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education
- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
- Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.

PHY(L) 121 LAB: ELECTRICITY AND MAGNETISM**Contact Hours: 60****Full Marks = 50** [End Semester Exam (35) Internal Assessment (15)]**Pass Mark = 20** [End Semester Exam (14)]

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series RC Circuit.
3. To determine an unknown Low Resistance using Potentiometer.
4. To determine an unknown Low Resistance using Carey Foster's Bridge.
5. To compare capacitances using De'Sauty's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
7. To verify the Thevenin and Norton theorems.
8. To verify the Superposition, and Maximum power transfer theorems.
9. To determine self inductance of a coil by Anderson's bridge.
10. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.

11. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
12. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer
13. Determine a high resistance by leakage method using Ballistic Galvanometer.
14. To determine self-inductance of a coil by Rayleigh's method.
15. To determine the mutual inductance of two coils by Absolute method.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- Engineering Practical Physics, S.Panigrahi and B.Mallick, 2015, Cengage Learning.
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

Course Code: PHY 122
Course Title: WAVES AND OPTICS
Contact Hours: 60

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences. **(5 Lectures)**

Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal and unequal frequency and their uses. **(2 Lectures)**

Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves. **(5 Lectures)**

Unit 2: Velocity of Waves:

Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction. **(5 Lectures)**

Superposition of Two Harmonic Waves: Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N Harmonic Waves. **(7 Lectures)**

Unit 3: Wave Optics:

Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence. **(3 Lectures)**

Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index.

Unit 4: Interferometer:

Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer. **(4 Lectures)**

Diffraction: Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula. (Qualitative discussion only) **(2 Lectures)**

Fraunhofer diffraction: Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating. **(6 Lectures)**

Unit 5: Fresnel Diffraction:

Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire. **(8 Lectures)**

Holography: Principle of Holography. Recording and Reconstruction Method. Theory of Holography as Interference between two Plane Waves. Point source holograms. **(4 Lectures)**

Reference Books

- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
- Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
- Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
- The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
- The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
- Fundamental of Optics, A. Kumar, H.R. Gulati and D.R. Khanna, 2011, R. Chand Publications.

PHY(L) 122-LAB: WAVES AND OPTICS

Contact Hours: 60

Full Marks = 50 [End Semester Exam (35) Internal Assessment (15)]

Pass Mark = 20 [End Semester Exam (14)]

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify $\lambda^2 \propto T$ law.
2. To investigate the motion of coupled oscillators.
3. To study Lissajous Figures.
4. Kundt's tube experiment.
5. Familiarization with: Schuster's focusing; determination of angle of prism.
6. To determine refractive index of the Material of a prism using sodium source.
7. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
8. To determine the wavelength of sodium source using Michelson's interferometer.
9. To determine wavelength of sodium light using Fresnel Biprism.
10. To determine wavelength of sodium light using Newton's Rings.
11. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.

12. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
13. To determine dispersive power and resolving power of a plane diffraction grating.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

Course Code: PHY 131
Course Title: MATHEMATICAL PHYSICS-II
Contact Hours: 60

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity. **(12 Lectures)**

Unit 2: Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. **(12 Lectures)**

Unit 3: Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions ($J_0(x)$ and $J_1(x)$) and Orthogonality. **(12 Lectures)**

Unit 4: Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. **(4 Lectures)**

Theory of Errors: Systematic and Random Errors. Propagation of Errors. Normal Law of Errors. Standard and Probable Error. Least-squares fit. Error on the slope and intercept of a fitted line. **(6 Lectures)**

Unit 5: Partial Differential Equations: Solutions to partial differential equations using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes, diffusion Equation. **(14 Lectures)**

Reference Books:

- Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
- Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
- Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
- Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
- Partial Differential Equations for Scientists & Engineers, S.J. Farlow, 1993, Dover Pub.
- Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press
- Mathematical methods for Scientists & Engineers, D.A. McQuarrie, 2003, Viva Books

PHY(L) 131-LAB: MATHEMATICAL PHYSICS-II**Contact Hours: 60****Full Marks = 50** [End Semester Exam (35) Internal Assessment (15)]**Pass Mark = 20** [End Semester Exam (14)]

| Topics | Description with Applications |
|--|---|
| Introduction to Numerical computation Software Scilab/FORTRAN/C/ C++/ Matlab / Mathematica | Introduction to <i>Scilab/FORTRAN/C/C++/ Matlab/Mathematica</i> , Advantages and disadvantages, |
| Curve fitting, Least square fit, Goodness of fit, standard deviation | Ohms law to calculate R, Hooke's law to calculate spring Constant |
| Solution of Linear system of equations by Gauss elimination method and Gauss Seidal method. Diagonalization of matrices, Inverse of a matrix, Eigen vectors, eigen values problems | Solution of mesh equations of electric circuits (3 meshes) Solution of coupled spring mass systems (3 masses) |
| Generation of Special functions using User defined functions in Scilab | Generating and plotting Legendre Polynomials Generating and plotting Bessel function |
| Solution of ODE First order Differential equation Euler, modified Euler and Runge-Kutta second order methods Second order differential equation Fixed difference method | First order differential equation Radioactive decay, Current in RC, LC circuits with DC source, Newton's law of cooling, Classical equations of motion Second order Differential Equation, Harmonic oscillator (no friction), Damped Harmonic oscillator, Over damped, Critical damped, Oscillatory, Forced Harmonic oscillator, Transient and Steady state solution Apply above to LCR circuits also. |
| Partial differential equations | Partial Differential Equation: Wave equation, Heat equation, Poisson equation, Laplace equation |

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Complex Variables, A.S. Fokas & M.J. Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett
- Computational Physics, D.Walker, 1st Edn., 2015, Scientific International Pvt. Ltd.
- A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd Edn., Cambridge University Press
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: scientific and Engineering Applications: A.V. Wouwer, P. Saucez, C.V. Fernández. 2014 Springer
- Scilab by example: M. Affouf 2012, ISBN: 978-1479203444
- Scilab (A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand & Company
- Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing
- www.scilab.in/textbook_companion/generate_book/291

Course Code: PHY 262

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Title: NUCLEAR & PARTICLE PHYSICS

Theory: 75 Lectures

Full Marks = 100 [End Semester Exam (70) Internal Assessment (30)]

Pass Mark = 40 [End Semester Exam (28)

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1:General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excited states. (15 Lectures)

Unit 2:Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of various terms, condition of nuclear stability. Two nucleon separation energies (qualitative idea), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of nuclear force. (15 Lectures)

Unit 3:Radioactivity decay:(a) Alpha decay: basics of α -decay processes, qualitative idea of alpha emission theory, Geiger Nuttall law, α -decay spectroscopy. (b) Beta-decay: energy kinematics for beta-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. (10 Lectures)

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate. (7 Lectures)

Unit 4:Interaction of Nuclear Radiation with matter: Cerenkov radiation, Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production. (5 Lectures)

Detector for Nuclear Radiations: Ionization chamber, proportional counter and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). (5 Lectures)

Particle Accelerators: Van-de Graaff generator, Linear accelerator, Cyclotron, Betatrons. Accelerator facility available in India: (4 Lectures)

Unit 5:Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model. (14 Lectures)

Reference Books:

1. *Introductory nuclear Physics* by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
2. *Concepts of nuclear physics* by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
3. *Introduction to the physics of nuclei & particles*, R.A. Dunlap. (Thomson Asia, 2004)
4. *Introduction to Elementary Particles*, D. Griffith, John Wiley & Sons
5. *Quarks and Leptons*, F. Halzen and A.D. Martin, Wiley India, New Delhi
6. *Basic ideas and concepts in Nuclear Physics - An Introductory Approach* by K. Heyde (IOP- Institute of Physics Publishing, 2004).
7. *Radiation detection and measurement*, G.F. Knoll (John Wiley & Sons, 2000).
8. *Theoretical Nuclear Physics*, J.M. Blatt & V.F.Weisskopf (Dover Pub.Inc., 1991)

PHY (L) 262-Lab Tutorial: Nuclear and Particle Physics

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Special Note:

• Syllabus has been prepared according UGC syllabus for CBCS.

• The list of laboratory experiments is prepared in such a way that it matches with the course title. However the concerned teacher may include an experiment in the list or may exclude an experiment from the list after having a formal discussion with all other faculty members in a departmental meeting. The inclusion or exclusion of an experiment should be mentioned in the minutes of the departmental meeting. The above statement is approved by Board of studies, Department of Physics.

Course Code: PHY 132
Course Title: THERMAL PHYSICS
Contact Hours: 60

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Full Marks =100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks =40 [End Semester Exam (28)]

(Two questions of 14marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Introduction to Thermodynamics

Zeroth and First Law of Thermodynamics: Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient. **(7 Lectures)**

Second Law of Thermodynamics: Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale. **(8 Lectures)**

Unit 2: Entropy: Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature–Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero. **(9 Lectures)**

Thermodynamic Potentials: Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. **(3 Lectures)**

Unit 3: Maxwell's Thermodynamic Relations & Phase Transition

Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of C_p-C_v , (3) TdS Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process.

Phase Transition: First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations **(12 Lectures)**

Unit 4: Kinetic Theory of Gases

Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases. **(7 Lectures)**

Molecular Collisions: Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffu-

Unit 5: Real Gases: Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO₂ Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. P-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule-Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion. Joule-Thomson Cooling. **(10 Lectures)**

Reference Books:

- Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press
- Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
- Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
- Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University Press
- Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications.

PHY(L) 132-LAB: THERMAL PHYSICS

Contact Hours: 60

Full Marks = 50 [End Semester Exam (35) Internal Assessment (15)]

Pass Mark = 20 [End Semester Exam (14)]

1. To determine Mechanical Equivalent of Heat, J, by Joule's / Callender and Barne's constant flow method
2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus or any suitable method.
3. To determine the coefficient of linear expansion by optical lever method or any other suitable method.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method or any suitable method
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT)
6. To study the variation of resistance with temperature by Carry-Foster bridge and hence determine the temperature coefficient of the material using hotplate.
7. To study the variation of Thermo-emf of a Thermocouple with Difference of Temperature of its Two Junctions
8. To calibrate a thermocouple to measure temperature in a specified Range using
 - 1) Null Method, 2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature.

Reference Books

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

Course Code: PHY 133

Course Title: DIGITAL SYSTEMS AND APPLICATIONS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Contact Hours: 60

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks =40 [End Semester Exam (28) Internal Assessment (12)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Introduction to CRO: Block Diagram of CRO. Electron Gun, Deflection System and Time Base. Deflection Sensitivity. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. **(3 Lectures)**

Integrated Circuits (Qualitative treatment only): Active & Passive components. Discrete components. Wafer. Chip. Advantages and drawbacks of ICs. Scale of integration: SSI, MSI, LSI and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and Digital ICs. **(3 Lectures)**

Digital Circuits: Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application as Parity Checkers. **(6 Lectures)**

Unit 2: Boolean algebra: De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. **(6 Lectures)**

Data processing circuits: Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders. **(4 Lectures)**

Unit 3: Arithmetic Circuits: Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor. **(5 Lectures)**

Sequential Circuits: SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop. **(6 Lectures)**

Timers: IC 555: block diagram and applications: Astable multivibrator and Monostable multivibrator. **(3 Lectures)**

Unit 4: Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits). **(2 Lectures)**

Counters(4 bits): Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter. **(4 Lectures)**

Computer Organization: Input/Output Devices. Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map. **(6 Lectures)**

Unit 5: Intel 8085 Microprocessor Architecture: Main features of 8085. Block diagram. Components. Pin-out diagram. Buses. Registers. ALU. Memory. Stack memory. Timing & Control circuitry. Timing states. Instruction cycle, Timing diagram of MOV and MVI. **(8 Lectures)**

Introduction to Assembly Language: 1 byte, 2 byte & 3 byte instructions. **(4 Lectures)**

Reference Books:

- Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Ed., 2011, Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Digital Electronics G K Kharate, 2010, Oxford University Press
- Digital Systems: Principles & Applications, R.J. Tocci, N.S. Widmer, 2001, PHI Learning
- Logic circuit design, Shimon P. Vingron, 2012, Springer.
- Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
- Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill
- Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.

PHY(L) 133-LAB: DIGITAL SYSTEMS AND APPLICATIONS**Contact Hours: 60****Full Marks = 50** [End Semester Exam (35) Internal Assessment (15)]**Pass Mark = 20** [End Semester Exam (14)]

1. To verify the truth tables of AND, OR, NOT, NOR and NAND gates.
2. To design a combinational logic system for a specified Truth Table.
3. To convert a Boolean expression into logic circuit and design it using logic gate ICs
4. To design and verify the De Morgan's theorem using breadboard.
5. To design and verify Half Adder and Full Adder.
6. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
7. To build JK Master-slave flip-flop using Flip-Flop ICs
8. To build a 4-bit Counter using D-type/JK Flip-Flop ICs and study timing diagram.
9. To design an astable multivibrator of given specifications using 555 Timer.
10. To design a monostable multivibrator of given specifications using 555 Timer.
11. To measure (a) Voltage, (b) rise and fall times and (c) Time period of a periodic waveform using CRO.
12. Write the following programs using 8085 Microprocessor
 - a) Addition and subtraction of numbers using direct addressing mode
 - b) Addition and subtraction of numbers using indirect addressing mode
 - c) Multiplication by repeated addition.
 - f) Use of CALL and RETURN Instruction.

Reference Books:

- Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill.
- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Microprocessor Architecture Programming and applications with 8085, R.S. Goankar, 2002, Prentice Hall.
- Microprocessor 8085: Architecture, Programming and interfacing, A. Wadhwa, 2010, PHI Learning.

Course Code: PHY 141
Course Title: MATHEMATICAL PHYSICS-III
Contact Hours: 60

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28) Internal Assessment (12)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Complex Analysis: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions.
(12 Lectures)

Unit 2: Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solving Definite Integrals.
(12 Lectures)

Unit 3: Integrals Transforms:

Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.). Three dimensional Fourier transforms with examples. Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations.
(15 Lectures)

Unit 4: Laplace Transforms: Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of 1st and 2nd order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions.
(10 Lectures)

Unit 5: Convolution Theorem. Inverse LT. Application of Laplace Transforms to 2nd order Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits, Coupled differential equations of 1st order. Solution of heat flow along infinite bar using Laplace transform.
(11 Lectures)

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Mathematics for Physicists, P. Dennery and A.Krzywicki, 1967, Dover Publications
- Complex Variables, A.S.Fokas & M.J.Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
- Complex Variables, A.K. Kapoor, 2014, Cambridge Univ. Press
- Complex Variables and Applications, J.W. Brown & R.V. Churchill, 7th Ed. 2003, Tata McGraw-Hill
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett

PHY(L) 141-LAB : MATHEMATICAL PHYSICS-III**Contact Hours: 60****Full Marks = 50** [End Semester Exam (35) Internal Assessment (15)]**Pass Mark = 20** [End Semester Exam (14)]**Scilab/FORTRAN/C/C++ /others based simulations experiments on Mathematical Physics problems like**

1. Solve differential equations:

$$dy/dx = e^{-x} \text{ with } y = 0 \text{ for } x = 0$$

$$dy/dx + e^{-x}y = x^2$$

$$d^2y/dt^2 + 2 dy/dt = -y$$

$$d^2y/dt^2 + e^{-t}dy/dt = -y$$

2. Dirac Delta Function:

Evaluate $\frac{1}{\sqrt{2\pi\sigma^2}} \int e^{-\frac{(x-2)^2}{2\sigma^2}} (x+3) dx$, for $\sigma = 1, 0.1, 0.01$ and show it tends to 5.

3. Fourier Series:

Program to sum $\sum_{n=1}^{\infty} (0.2)^n$

Evaluate the Fourier coefficients of a given periodic function (square wave)

4. Frobenius method and Special functions:

$$\int_{-1}^{+1} P_n(\mu)P_m(\mu)d\mu = \delta_{n,m}$$

Plot $P_n(x)$, $J_\nu(x)$

Show recursion relation

25

5. Calculation of error for each data point of observations recorded in experiments done in previous semesters (choose any two).

1. Calculation of least square fitting manually without giving weightage to error. Confirmation of least square fitting of data through computer program.
2. Evaluation of trigonometric functions e.g. $\sin \theta$, Given Bessel's function at N points find its value at an intermediate point. Complex analysis: Integrate $1/(x^2+2)$ numerically and check with computer integration.
3. Compute the n^{th} roots of unity for $n = 2, 3$, and 4.
4. Find the two square roots of $-5+12j$.
5. Integral transform: FFT of
6. Solve Kirchoff's Current law for any node of an arbitrary circuit using Laplace's transform.
7. Solve Kirchoff's Voltage law for any loop of an arbitrary circuit using Laplace's transform.
8. Perform circuit analysis of a general LCR circuit using Laplace's transform.

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014 Springer ISBN: 978-3319067896
- A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd Edn., Cambridge University Press
- Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
- Scilab (A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand & Company
- Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing
- https://web.stanford.edu/~boyd/ee102/laplace_ckts.pdf

Course Code: PHY 142
Course Title: ELEMENTS OF MODERN PHYSICS
Contact Hours: 60

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks =40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude and wave functions. **(11 Lectures)**

Unit 2: Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle- application to Size and structure of atomic nucleus, Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. **(13 Lectures)**

Unit 3: Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension. **(11 Lectures)**

Unit 4: One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as example; Quantum mechanical scattering and tunnelling in one dimension- across a step potential & rectangular potential barrier. **(8 Lectures)**

Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers. **(4 Lectures)**

Unit 5: Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay; Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity of a nucleus. **(6 Lectures)**

Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions driving stellar energy (brief qualitative discussions). **(3 Lectures)**

Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser. Basic lasing. **(4 Lectures)**

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
- Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
- Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
- Physics for scientists and Engineers with Modern Physics, Jewett and Serway, 2010, Cengage Learning.
- Modern Physics, G.Kaur and G.R. Pickrell, 2014, McGraw Hill

Additional Books for Reference

- Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson, 2004, PHI Learning.
- Theory and Problems of Modern Physics, Schaum's outline, R. Gautreau and W. Savin, 2nd Edn, Tata McGraw-Hill Publishing Co. Ltd.
- Quantum Physics, Berkeley Physics, Vol.4. E.H.Wichman, 1971, Tata McGraw-Hill Co.
- Basic ideas and concepts in Nuclear Physics, K.Heyde, 3rd Edn., Institute of Physics Pub.
- Six Ideas that Shaped Physics: Particle Behave like Waves, T.A.Moore, 2003, McGraw Hill

PHY(L) 142-LAB: ELEMENTS OF MODERN PHYSICS**Contact Hours: 60****Full Marks = 50** [End Semester Exam (35) Internal Assessment (15)]**Pass Mark = 20** [End Semester Exam (14) Internal Assessment(6)]

1. Measurement of Planck's constant using black body radiation and photo-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light;
maximum energy of photo-electrons versus frequency of light
3. To determine work function of material of filament of directly heated vacuum diode.
4. To determine the Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the value of e/m by Magnetic focusing/ Bar magnet or by any suitable method.
7. To setup the Millikan oil drop apparatus and determine the charge of an electron.
8. To show the tunnelling effect in tunnel diode using I-V characteristics.
9. To determine the wavelength of laser source using diffraction of single slit.
10. To determine the wavelength of laser source using diffraction of double slits.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal
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Course Code: PHY 143

Course Title: ANALOG SYSTEMS AND APPLICATIONS

Contact Hours: 60

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Semiconductor Diodes: P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity. PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode. Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width and Current for Step Junction. Current Flow Mechanism in Forward and Reverse Biased Diode. **(10 Lectures)**

Unit 2: Two-terminal Devices and their Applications: (1) Rectifier Diode: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, C-filter (2) Zener Diode and Voltage Regulation. Principle and structure of (1) LEDs, (2) Photodiode and (3) Solar Cell **(6 Lectures)**

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β Relations between α and β . Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and Saturation Regions. **(6 Lectures)**

Unit 3: Amplifiers: Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers. **(10 Lectures)**

Coupled Amplifier: Two stage RC-coupled amplifier and its frequency response **(4 Lectures)**

Unit 4: Feedback in Amplifier: Effects of Positive and Negative, Feedback on Input Impedance, Output Impedance, Gain, Stability, Distortion and Noise. **(4 Lectures)**

Sinusoidal Oscillators: Barkhausen's Criterion for self-sustained oscillations. RC Phase shift oscillator, determination of Frequency. Hartley & Colpitts oscillators. **(4 Lectures)**

Operational Amplifiers (Black Box approach): Characteristics of an Ideal and Practical Op-Amp. (IC 741) Open-loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and concept of Virtual ground. **(4 Lectures)**

Unit 5: Applications of Op-Amps: (1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Log amplifier, (7) Zero crossing detector (8) Wein bridge oscillator. **(9 Lectures)**

Conversion: Resistive network (Weighted and R-2R Ladder). Accuracy and Resolution. A/D Conversion (successive approximation) **(3 Lectures)**

Reference Books:

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
- Solid State Electronic Devices, B.G.Streetman & S.K.Banerjee, 6th Edn.,2009, PHI Learning
- Electronic Devices & circuits, S.Salivahanan & N.S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
- Electronic circuits: Handbook of design & applications, U.Tietze, C.Schenk,2008, Springer
- Semiconductor Devices: Physics and Technology, S.M. Sze, 2nd Ed., 2002, Wiley India
- Microelectronic Circuits, M.H. Rashid, 2nd Edition, Cengage Learning
- Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

PHY(L) 143-LAB :ANALOG SYSTEMS AND APPLICATIONS**Contact Hours: 60**

Full Marks = 50 [End Semester Exam (35) Internal Assessment (15)]
Pass Mark = 20 [End Semester Exam (14)]

1. To study V-I characteristics of PN junction diode, and Light emitting diode.
2. To study the V-I characteristics of a Zener diode and its use as voltage regulator.
3. Study of V-I & power curves of solar cells, and find maximum power point & efficiency.
4. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
5. To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.
6. To study the frequency response of voltage gain of a single stage RC-coupled transistor amplifier.
7. To design a phase shift oscillator of given specifications using BJT.
8. To design a Wien bridge oscillator for given frequency using an op-amp.
9. To study the analog to digital convertor (ADC) IC.
10. To design an inverting amplifier using Op-amp (741,351) for dc input voltage and study its closed loop gain.
11. To design inverting amplifier using Op-amp (741,351) and study its frequency response
12. To design non-inverting amplifier using Op-amp (741,351) & study its frequency response
13. To investigate the use of an op-amp (741,351) as an Integrator and Differentiator.
14. To add two dc voltages using Op-amp (741,351) in inverting and non-inverting mode
15. To investigate the use of an op-amp (741,351) as adder and subtractor.

Reference Books:

- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.
- Electronic Devices & circuit Theory, R.L. Boylestad & L.D. Nashelsky, 2009, Pearson

Course Code: PHY 151

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Title: QUANTUM MECHANICS

Contact Hours: 60

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Time dependent Schrodinger equation: Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle. **(10 Lectures)**

Unit 2: Time independent Schrodinger equation-Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to spread of Gaussian wave-packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle. **(10 Lectures)**

Unit 3: General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem-square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method; Hermite polynomials; ground state, zero point energy & uncertainty principle. **(10 Lectures)**

Unit 4: Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for second order partial differential equation; angular momentum operator & quantum numbers; Radial wavefunctions from Frobenius method; shapes of the probability densities for ground & first excited states; Orbital angular momentum quantum numbers l and m ; s, p, d,.. shells. **(10 Lectures)**

Atoms in Electric & Magnetic Fields: Electron angular momentum. Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Electron Magnetic Moment, Gyromagnetic Ratio and Bohr Magneton, Spin Magnetic Moment. Stern-Gerlach Experiment.. **(6 Lectures)**

Unit 5: Atoms in External Magnetic Fields:- Zeeman Effect: Normal and Anomalous Zeeman Effect. Paschen Back and Stark Effect (Qualitative Discussion only). **(4 Lectures)**

Many electron atoms: Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total angular momentum. Vector Model. Spin-orbit coupling in atoms-L-S and J-J couplings. Hund's Rule. Term symbols. Spectra of Hydrogen and Alkali atoms(Na etc.). **(10 Lectures)**

Reference Books:

- A Text book of Quantum Mechanics, P.M.Mathews and K.Venkatesan, 2nd Ed., 2010, McGraw Hill
- Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
- Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
- Quantum Mechanics, G. Aruldhas, 2nd Edn. 2002, PHI Learning of India.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
- Quantum Mechanics: Foundations & Applications, Arno Bohm, 3rd Edn., 1993, Springer
- Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press

Additional Books for Reference

- Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
- Introduction to Quantum Mechanics, D.J. Griffith, 2nd Ed. 2005, Pearson Education

PHY(L) 151-LAB: QUANTUM MECHANICS

Contact Hours: 60

Full Marks = 50 [End Semester Exam (35) Internal Assessment (15)]

Pass Mark = 20 [End Semester Exam (14)]

Use C/C++/Scilab/FORTRAN/Others for solving the following problems based on Quantum Mechanics like

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom:

$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2} [V(r) - E] \text{ where } V(r) = -\frac{e^2}{r}$$

Here, m is the reduced mass of the electron. Obtain the energy eigenvalues and plot the corresponding wavefunctions. Remember that the ground state energy of the hydrogen atom is ≈ -13.6 eV. Take $e = 3.795$ (eVÅ)^{1/2}, $\hbar c = 1973$ (eVÅ) and $m = 0.511 \times 10^6$ eV/c².

2. Solve the s-wave radial Schrodinger equation for an atom:

$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2} [V(r) - E]$$

where m is the reduced mass of the system (which can be chosen to be the mass of an electron), for the screened coulomb potential

$$V(r) = -\frac{e^2}{r} e^{-r/a}$$

Find the energy (in eV) of the ground state of the atom to an accuracy of three significant digits. Also, plot the corresponding wavefunction. Take $e = 3.795$ (eVÅ)^{1/2}, $m = 0.511 \times 10^6$ eV/c², and $a = 3$ Å, 5 Å, 7 Å. In these units $\hbar c = 1973$ (eVÅ). The ground state energy is expected to be above -12 eV in all three cases.

3. Solve the s-wave radial Schrodinger equation for a particle of mass m :

$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2} [V(r) - E]$$

For the anharmonic oscillator potential

$$V(r) = \frac{1}{2} kr^2 + \frac{1}{3} br^3$$

for the ground state energy (in MeV) of particle to an accuracy of three significant digits. Also, plot the corresponding wave function. Choose $m = 940$ MeV/c², $k = 100$ MeV fm⁻², $b = 0, 10, 30$ MeV fm⁻³. In these units, $\hbar c = 197.3$ MeV fm. The ground state energy is expected to lie between 90 and 110 MeV for all three cases.

4. Solve the s-wave radial Schrodinger equation for the vibrations of hydrogen molecule:

$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2\mu}{\hbar^2} [V(r) - E]$$

Where μ is the reduced mass of the two-atom system for the Morse potential

$$V(r) = D(e^{-2\alpha r'} - e^{-\alpha r'}), \quad r' = \frac{r - r_0}{r_0}$$

Find the lowest vibrational energy (in MeV) of the molecule to an accuracy of three significant digits. Also plot the corresponding wave function.

Take: $m = 940 \times 10^6$ eV/c², $D = 0.755501$ eV, $\alpha = 1.44$, $r_0 = 0.131349$ Å

Laboratory based experiments:

- Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
- Study of Zeeman effect: with external magnetic field; Hyperfine splitting
- To show the tunneling effect in tunnel diode using I-V characteristics.
- Quantum efficiency of CCDs

Reference Books:

- Schaum's outline of Programming with C++. J. Hubbard, 2000, McGraw-Hill Publication
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Press et al., 3rd Edn., 2007, Cambridge University Press.
- An introduction to computational Physics, T. Pang, 2nd Edn., 2006, Cambridge Univ. Press
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific & Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014 Springer.
- Scilab (A Free Software to Matlab): H. Ramchandran, A.S. Nair. 2011 S. Chand & Co.
- A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd Edn., Cambridge University Press
- Scilab Image Processing: L.M. Surhone. 2010 Betascript Publishing ISBN:978-6133459274

Course Code: PHY 152

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Title: SOLID STATE PHYSICS

Contact Hours: 60

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1:Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor. **(12 Lectures)**

Unit 2:Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law **(10 Lectures)**

Unit 3:Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia- and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss. **(10 Lectures)**

Unit 4:Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeier relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons, TO modes. **(8 Lectures)**

Ferroelectric Properties of Materials: Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop. **(6 lectures)**

Unit 5:Elementary band theory: Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient. **(8 Lectures)**

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation) **(6 Lectures)**

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 4th Edition, 2015, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
- Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
- Solid State Physics, Rita John, 2014, McGraw Hill
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

PHY(L) 152-LAB : SOLID STATE PHYSICS**Contact Hours: 60****Full Marks = 50** [End Semester Exam (35) Internal Assessment (15)]**Pass Mark = 20** [End Semester Exam (14)]

1. Measurement of susceptibility of paramagnetic solution by (Quinck`s Tube Method)/suitable method.
2. To measure the Magnetic susceptibility of Solids.
3. To measure the Dielectric Constant of a dielectric Material by suitable method.
4. To study the PE Hysteresis loop of a Ferroelectric Crystal.
5. To draw the BH curve of Fe using Solenoid/transformer & determine energy loss from Hysteresis.
6. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150 °C) and to determine its band gap.
7. To determine the Hall coefficient of a semiconductor sample.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India.

Course Code: PHY 161

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Title: ELECTROMAGNETIC THEORY**Contact Hours: 60****Full Marks = 100** [End Semester Exam (70) Internal Assessment(30)]**Pass Marks = 40** [End Semester Exam (28)]**(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)**

Unit 1: Maxwell Equations: Review of Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Boundary Conditions at Interface between Different Media. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density. **(12 Lectures)**

Unit 2: EM Wave Propagation in Unbounded Media: Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth. Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth, application to propagation through ionosphere. **(10 Lectures)**

Unit 3: EM Wave in Bounded Media: Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law. Reflection & Transmission coefficients. Total internal re-

Unit 4: Polarization of Electromagnetic Waves: Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Symmetric Nature of Dielectric Tensor. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Babinet Compensator and its Uses. Analysis of Polarized Light **(12 Lectures)**

Rotatory Polarization: Optical Rotation. Biot's Laws for Rotatory Polarization. Fresnel's Theory of optical rotation. Calculation of angle of rotation. Experimental verification of Fresnel's theory. Specific rotation. Laurent's half-shade polarimeter. **(5 Lectures)**

Unit 5: Wave Guides: Planar optical wave guides. Planar dielectric wave guide. Condition of continuity at interface. Phase shift on total reflection. Eigenvalue equations. Phase and group velocity of guided waves. Field energy and Power transmission. **(8 Lectures)**

Optical Fibres:- Numerical Aperture. Step and Graded Indices (Definitions Only). Single and Multiple Mode Fibres (Concept and Definition Only). **(3 Lectures)**

Reference Books:

- Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed., 1998, Benjamin Cummings.
- Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
- Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning
- Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill
- Electromagnetic field Theory, R.S. Kshetrimayun, 2012, Cengage Learning
- Engineering Electromagnetic, William H. Hayt, 8th Edition, 2012, McGraw Hill.
- Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer

Additional Books for Reference

- Electromagnetic Fields & Waves, P.Lorrain & D.Corson, 1970, W.H.Freeman & Co.
- Electromagnetics, J.A. Edminster, Schaum Series, 2006, Tata McGraw Hill.
- Electromagnetic field theory fundamentals, B. Guru and H. Hiziroglu, 2004, Cambridge

PHY (L)161-LAB : ELECTROMAGNETIC THEORY

Contact Hours: 60

Full Marks = 50 [End Semester Exam (35) Internal Assessment (15)]

Pass Mark = 20 [End Semester Exam (14) Internal Assessment(6)]

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of sugar solution using Polarimeter.
3. To analyze elliptically polarized Light by suitable method (using a Babinet's compensator).
4. To study the polarization of light by reflection and determine the polarizing angle and hence determine the refractive index of the material.
5. To verify the Stefan's law of radiation and to determine Stefan's constant.
6. To determine the Boltzmann constant using V-I characteristics of PN junction Diode

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
 - Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
 - A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
 - Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer
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Course Code: PHY 162
Course Title: STATISTICAL MECHANICS
Contact Hours: 60

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Classical Statistics: Macrostate & Microstate, Elementary Concept of Ensemble, Phase Space, Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Partition Function, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, Gibbs Paradox, Sackur Tetrode equation, Law of Equipartition of Energy (with proof) – Applications to Specific Heat and its Limitations, Thermodynamic Functions of a Two-Energy Levels System, Negative Temperature. **(16 Lectures)**

Unit 2: Classical Theory of Radiation: Properties of Thermal Radiation. Blackbody Radiation. Pure temperature dependence. Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation Pressure. Wien's Displacement law. Wien's Distribution Law. Saha's Ionization Formula. Rayleigh-Jean's Law. Ultraviolet Catastrophe. **(11 Lectures)**

Unit 3: Quantum Theory of Radiation: Spectral Distribution of Black Body Radiation. Planck's Quantum Postulates. Planck's Law of Blackbody Radiation: Experimental Verification. Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law, (4) Wien's Displacement law from Planck's law. **(13 Lectures)**

Unit 4: Bose-Einstein Statistics: B-E distribution law, Thermodynamic functions of a strongly Degenerate Bose Gas, Bose Einstein condensation, properties of liquid He (qualitative description), Radiation as a photon gas and Thermodynamic functions of photon gas. Bose derivation of Planck's law. **(10 Lectures)**

Unit 5: Fermi-Dirac Statistics: Fermi-Dirac Distribution Law, Thermodynamic functions of a Completely and strongly Degenerate Fermi Gas, Fermi Energy, Electron gas in a Metal, Specific Heat of Metals, Relativistic Fermi gas, White Dwarf Stars, Chandrasekhar Mass Limit. **(10 Lectures)**

Reference Books:

- Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.
- Statistical Physics, Berkeley Physics Course, F. Reif, 2008, Tata McGraw-Hill
- Statistical and Thermal Physics, S. Lokanathan and R.S. Gambhir. 1991, Prentice Hall
- Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
- An Introduction to Statistical Mechanics & Thermodynamics, R.H. Swendsen, 2012, Oxford Univ. Press

PHY 162-LAB STATISTICAL MECHANICS**Contact Hours: 60****Full Marks = 50** [End Semester Exam (35) Internal Assessment (15)]**Pass Mark = 20** [End Semester Exam (14)]

Use C/C++/Scilab/FORTRAN/other numerical simulations for solving the problems based on Statistical Mechanics like

1. Computation of the partition function $Z(b)$ for examples of systems with a finite number of single particle levels (e.g., 2 level, 3 level, etc.) and a finite number of non-interacting particles N under Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics:
 - a. Study of how $Z(b)$, average energy $\langle E \rangle$, energy fluctuation ΔE , specific heat at constant volume C_v , depend upon the temperature, total number of particles N and the spectrum
 1. of single particle states.
 - b. Ratios of occupation numbers of various states for the systems considered above
 - c. Computation of physical quantities at large and small temperature T and comparison of various statistics at large and small temperature T .
2. Plot Planck's law for Black Body radiation and compare it with Raleigh-Jeans Law at high temperature and low temperature.
3. Plot Specific Heat of Solids (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature and low temperature and compare them for these two cases.
4. Plot the following functions with energy at different temperatures
 - a. Maxwell-Boltzmann distribution
 - b. Fermi-Dirac distribution
 - c. Bose-Einstein distribution

Reference Books:

- Elementary Numerical Analysis, K.E. Atkinson, 3rd Edition, 2007, Wiley India Edition
 - Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.
 - Introduction to Modern Statistical Mechanics, D. Chandler, Oxford University Press, 1987
 - Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
 - Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
 - Statistical and Thermal Physics with computer applications, Harvey Gould and Jan Tobochnik, Princeton University Press, 2010.
 - Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014 Springer ISBN: 978-3319067896
 - Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
 - Scilab Image Processing: L.M. Surhone. 2010, Betascript Pub., ISBN: 978-6133459274
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II. DISCIPLINE SPECIFIC ELECTIVE COURSE(DSE)

Course Code: PHY 251
Course Title: CLASSICAL MECHANICS
Contact Hours: 75

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]
Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit: 1: Classical Mechanics Lagrangian formalism:

Review of Newtonian Mechanics; Application to the motion of a charge particle in external electric and magnetic fields- motion in uniform electric field, magnetic field- gyroradius and gyrofrequency, motion in crossed electric and magnetic fields. Generalized coordinates and velocities, Hamilton's principle, Lagrangian and the Euler-Lagrange equations, one-dimensional examples of the Euler-Lagrange equations- one-dimensional Simple Harmonic Oscillations and falling body in uniform gravity (15 Lectures)

Unit: 2 Hamiltonian Formalism: Canonical momenta & Hamiltonian. Hamilton's equations of motion. Applications: Hamiltonian for a harmonic oscillator, solution of Hamilton's equation for Simple Harmonic Oscillations; particle in a central force field- conservation of angular momentum and energy. (15 Lectures)

Unit: 3:Small Amplitude Oscillations: Minima of potential energy and points of stable equilibrium, expansion of the potential energy around a minimum, small amplitude oscillations about the minimum, normal modes of oscillations example of N identical masses connected in a linear fashion to (N -1) - identical springs. (15 Lectures)

Unit 4: Special Theory of Relativity: Postulates of Special Theory of Relativity. Lorentz Transformations. Minkowski space. The invariant interval, light cone and world lines. Space-time diagrams. Time -dilation, length contraction and twin paradox. Four-vectors: space-like, time-like and light-like. Four-velocity and acceleration. Four-momentum and energy-momentum relation. (15 Lectures)

Unit 5: Fluid Dynamics: Density ρ and pressure P in a fluid, an element of fluid and its velocity, continuity equation and mass conservation, stream-lined motion, laminar flow, Poiseuille's equation for flow of a liquid through a pipe, Navier-Stokes equation, qualitative description of turbulence, Reynolds number. (15 Lectures)

Reference Books:

- Classical Mechanics, H.Goldstein, C.P. Poole, J.L. Safko, 3rd Edn. 2002, Pearson Education.
- Mechanics, L. D. Landau and E. M. Lifshitz, 1976, Pergamon.
- Classical Electrodynamics, J.D. Jackson, 3rd Edn., 1998, Wiley.
- The Classical Theory of Fields, L.D Landau, E.M Lifshitz, 4th Edn., 2003, Elsevier.
- Introduction to Electrodynamics, D.J. Griffiths, 2012, Pearson Education.
- Classical Mechanics, P.S. Joag, N.C. Rana, 1st Edn., McGraw Hall.
- Classical Mechanics, R. Douglas Gregory, 2015, Cambridge University Press.
- Classical Mechanics: An introduction, Dieter Strauch, 2009, Springer.
- Solved Problems in classical Mechanics, O.L. Delange and J. Pierrus, 2010, Oxford Press

Course Code: PHY 252
Course Title: MEDICAL PHYSICS
Contact Hours: 60

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

(Credits: Theory-04, Practicals-02)

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

UNIT I: PHYSICS OF THE BODY-I

Basic Anatomical Terminology: Standard Anatomical Position, Planes. Familiarity with terms like- Superior, Inferior, Anterior, Post erior, Medial, Lateral, Proximal and Distal. Mechanics of the body: Skeleton, forces, and body stability. Muscles and dynamics of body movement. Physics of Locomotors Systems: joints and movements, Stability and Equilibrium. Energy household of the body: Energy balance in the body, Energy consumption of the body, Heat losses of the body, Thermal Regulation. Pressure system of body: Physics of breathing, Physics of cardiovascular system. **(10Lectures)**

UNIT II: PHYSICS OF THE BODY-II

Acoustics of the body: Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics with sound and ultrasound. Optical system of the body: Physics of the eye. Electrical system of the body: Physics of the nervous system, Electrical signals and information transfer. **(10 Lectures)**

UNIT III: PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-I

X-RAYS: Electromagnetic spectrum, production of x-rays, x-ray spectra, Bremsstrahlung, Characteristic x-ray. X-ray tubes & types : Coolidge tube, x-ray tube design, tube cooling stationary mode, Rotating anode x-ray tube, Tube rating, quality and intensity of x-ray. X-ray generator circuits, half wave and full wave rectification, filament circuit, kilo voltage circuit. Single and three phase electric supply. Power ratings. Types of X-Ray Generator, high frequency generator, exposure timers and switches, HT cables. **(7 Lectures)**

RADIATION PHYSICS: Radiation units exposure, absorbed dose, units: rad, gray, relative biological effectiveness, effective dose- Rem & Sievert, inverse square law. Interaction of radiation with matter Compton & photoelectric effect, linear attenuation coefficient. Radiation Detectors : ionization (Thimble chamber, condenser chamber), chamber. Geiger Muller counter, Scintillation counters and Solid State detectors, TFT. **(6 Lectures)**

UNIT IV: MEDICAL IMAGING PHYSICS: Evolution of Medical Imaging, X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR), NMR imaging, MRI Radiological imaging, Ultrasound imaging, Physics of Doppler with applications and modes, Vascular Doppler. Radiography: Filters, grids, cassette, X-ray film, film processing, fluoroscopy. Computed tomography scanner- principle and function, display, generations, mammography. Thyroid uptake system and Gamma camera (Only Principle, function and display). **(8 Lectures)**

RADIATION ONCOLOGY PHYSICS I: External Beam Therapy (Basic Idea): Telecobalt, Conformal Radiation Therapy (CRT), 3DCRT, IMRT, Image Guided Radiotherapy, EPID, Rapid Arc, Proton Therapy, Gamma Knife, Cyber Knife. Contact Beam Therapy (Basic Idea): Brachytherapy- LDR and HDR, Intra Operative Brachytherapy. Radiotherapy, kilo voltage machines, deep therapy machines, Telecobalt machines, Medical linear accelerator. **(5Lectures)**

UNIT V : RADIATION ONCOLOGY PHYSICS II: Basics of Teletherapy units, deep X-ray, Telecobalt units, Radiation protection, external beam characteristics, dose maximum and build up – bolus, percentage depth dose, tissue maximum ratio and tissue phantom ratio, Planned target Volume and Gross Tumour Volume. **(4Lectures)**

RADIATION AND RADIATION PROTECTION: Principles of radiation protection, protective materials-radiation effects, somatic, genetic stochastic and deterministic effect. Personal monitoring devices: TLD film badge, pocket dosimeter, OSL dosimeter. Radiation dosimeter. Natural radioactivity, Biological effects of radiation, Radiation monitors. Steps to reduce radiation to Patient, Staff and Public. Dose Limits for Occupational workers and Public. AERB: Existence and Purpose. **(5 Lectures)**

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-II

Diagnostic nuclear medicine: Radiopharmaceuticals for radioisotope imaging, Radioisotope imaging equipment, Single photon and positron emission tomography. Therapeutic nuclear medicine: Interaction between radiation and matter Dose and isodose in radiation treatment. Medical Instrumentation: Basic Ideas of Endoscope and Cautery, Sleep Apnea and Cpap Machines, Ventilator and its modes. **(5 Lectures)**

Reference Books:

1. Medical Physics, J.R. Cameron and J.G.Skofronick, Wiley (1978)
2. Basic Radiological Physics Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
3. Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990)
4. Physics of the human body, Irving P. Herman, Springer (2007).
5. Physics of Radiation Therapy : F M Khan - Williams and Wilkins, 3rd edition (2003)
6. The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
7. Handbook of Physics in Diagnostic Imaging: R.S.Livingstone: B.I. Publication Pvt Ltd.
8. The Physics of Radiology-H E Johns and Cunningham.

PHY252 LAB: Medical Physics

ontact Hours: 60

Full Marks = 50 [End Semester Exam (35) Internal Assessment(15)]

Pass Marks = 20 [End Semester Exam (14)]

1. Understanding the working of a manual Hg Blood Pressure monitor and measure the Blood Pressure.
2. Understanding the working of a manual optical eye-testing machine and to learn eye-testing procedure.
3. Correction of Myopia (short sightedness) using a combination of lenses on an optical bench/ breadboard.
4. Correction of Hypermetropia/Hyperopia (long sightedness) using a combination of lenses on an optical bench/breadboard.
5. To learn working of Thermoluminescent dosimeter (TLD) badges and measure the background radiation.
6. Familiarization with Geiger-Muller (G M) Counter and to measure background radiation.
7. Familiarization with Radiation meter and to measure background radiation.
8. Familiarization with the Use of a Vascular Doppler.

Reference Books:

1. Basic Radiological Physics, Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
2. Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990)
3. Physics of Radiation Therapy : F M Khan - Williams and Wilkins, 3rd edition (2003)
4. The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
5. Handbook of Physics in Diagnostic Imaging: Roshan S. Livingstone: B. I. Publications Pvt Ltd.
6. The Physics of Radiology-H E Johns and Cunningham.

Course Code: PHY 261
Course Title: PHYSICS OF EARTH
Contact Hours: 75

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

(Credits: Theory-05, Tutorials-01)

Full Marks = 100 [End Semester Exam (70) Internal Assessment (30)]

Pass Mark = 40 [End Semester Exam (28)]

Unit 1: The Earth and the Universe : (17 Lectures)

- Origin of universe, creation of elements and earth. A Holistic understanding of our dynamic planet through Astronomy, Geology, Meteorology and Oceanography . Introduction to various branches of Earth Sciences.
- General characteristics and origin of the Universe. The Milky Way galaxy, solar system, Earth's orbit and spin, the Moon's orbit and spin. The terrestrial and Jovian planets. Meteorites & Asteroids. Earth in the Solar system, origin, size, shape, mass, density, rotational and revolution parameters and its age.
- Energy and particle fluxes incident on the Earth.
- The Cosmic Microwave Background.

Unit 2: Structure: (18 Lectures)

- The Solid Earth: Mass, dimensions, shape and topography, internal structure, magnetic field, geothermal energy. How do we learn about Earth's interior?
- The Hydrosphere: The oceans, their extent, depth, volume, chemical composition. River systems.
- The Atmosphere: variation of temperature, density and composition with altitude, clouds.
- The Cryosphere: Polar caps and ice sheets. Mountain glaciers.
- The Biosphere: Plants and animals. Chemical composition, mass. Marine and land organisms.

Unit 3: Dynamical Processes : (18 Lectures)

- The Solid Earth: Origin of the magnetic field. Source of geothermal energy. Convection in Earth's core and production of its magnetic field. Mechanical layering of the Earth. Introduction to geophysical methods of earth investigations. Concept of plate tectonics; sea- floor spreading and continental drift. Geodynamic elements of Earth: Mid Oceanic Ridges, trenches, transform faults and island arcs. Origin of oceans, continents, mountains and rift valleys. Earthquake and earthquake belts. Volcanoes: types products and distribution.
- The Hydrosphere: Ocean circulations. Oceanic current system and effect of Coriolis forces. Concepts of eustasy, tectonic – air-sea interaction; wave erosion and beach processes. Tides. Tsunamis.
- The Atmosphere: Atmospheric circulation. Weather and climatic changes. Earth's heat budget. Cyclones.

Unit 4: Climate: (12 Lectures)

- Earth's temperature and greenhouse effect.
- Paleoclimate and recent climate changes.
- The Indian monsoon system.
- Biosphere: Water cycle, Carbon cycle, Nitrogen cycle, Phosphorous cycle. The role of cycles in maintaining a steady state.

Evolution I:

Nature of stratigraphic records, Standard stratigraphic time scale and introduction to the concept of time in geological studies. Introduction to geochronological methods in their application in geological studies. History of development in concepts of uniformitarianism, catastrophism and neptunism. Law of superposition and faunal succession.

Unit 5: Evolution II:**(6 Lectures)**

Introduction to the geology and geomorphology of Indian subcontinent.

1. Time line of major geological and biological events.
2. Origin of life on Earth.
3. Role of the biosphere in shaping the environment.
4. Future of evolution of the Earth and solar system: Death of the Earth.

Disturbing the Earth – Contemporary dilemmas**(4 Lectures)**

- (a) Human population growth.
- (b) Atmosphere: Green house gas emissions, climate change, air pollution.
- (c) Hydrosphere: Fresh water depletion.
- (d) Geosphere: Chemical effluents, nuclear waste.
- (e) Biosphere: Biodiversity loss. Deforestation. Robustness and fragility of ecosystems.

Reference Books:

1. Planetary Surface Processes, H. Jay Melosh, Cambridge University Press, 2011.
2. Consider a Spherical Cow: A course in environmental problem solving, John Harte. University Science Books
3. Holme's Principles of Physical Geology. 1992. Chapman & Hall. 63
4. Emiliani, C, 1992. Planet Earth, Cosmology, Geology and the Evolution of Life and Environment. Cambridge University Press.

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PHY (L) 261**Contact Hours: 30****Lab Tutorial: PHYSICS OF EARTH****Full Marks: 50****Pass Mark: 20(End Sem (14)**

Topic: Analysis of Earth and atmosphere data by online/offline data processor/computer programming.

III. GENERIC ELECTIVE COURSE (GEC)

(For Students of other discipline)

Course Code: PHY 311
Course Title: MECHANICS
Contact Hours: 60

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Vectors:

Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. **(4 Lectures)**

Ordinary Differential Equations: 1st order homogeneous differential equations.

2nd order homogeneous differential equations with constant coefficients.

(6 Lectures)

Unit 2: Laws of Motion:

Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. **(6 Lectures)**

Momentum and Energy: Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets. **(6 Lectures)**

Rotational Motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum. **(5 Lectures)**

Unit 3: Gravitation:

Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).

(10 Lectures)

Unit 4: Oscillation: Simple harmonic motion, differential equation of SHM and its solutions. Kinetic and potential Energy, total energy and their time averages. Damped oscillations.

(8 Lectures)

Unit 5: Elasticity: Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder, Torsional pendulum. **(10 Lectures)**

Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.

(5 Lectures)

Reference Books:

- University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986. AddisonWesley
- Mechanics Berkeley Physics course, v.1: Charles Kittel, et. Al. 2007, Tata McGraw-Hill.
- Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
- Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press

PHY (L) 311-LAB: MECHANICS**Contact Hours: 60**

Full Marks = 50 [End Semester Exam (35) Internal Assessment (15)]
Pass Mark = 20 [End Semester Exam (14)]

Measurements of length (or diameter) using Vernier Calliper, screw gauge and travelling microscope.

1. To determine the Moment of Inertia of a regular body by torsional pendulum.
2. To determine the Young's Modulus of a Wire .
3. To determine the Modulus of Rigidity of a Wire .
4. To determine g by Bar Pendulum.
5. To determine g by Kater's Pendulum.
6. To determine g and velocity for a freely falling body using Digital Timing Technique
7. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g
8. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).

Reference Books:

- Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Course Code: PHY 321**Course Title: ELECTRICITY AND MAGNETISM****Contact Hours: 60**

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28)]

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Vector Analysis:

Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

(12 Lectures)**Unit 2: Electrostatics:**

Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

(15 Lectures)**Unit 3: Magnetism:**

Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials.

(13 Lectures)

Unit 4: Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic Field. Trasformer, Auto Trasformer, different losses of transformer.

(10 Lectures)**Unit 5: Maxwell's equations and Electromagnetic wave propagation:**

Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum.

(10 Lectures)**Reference Books:**

- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education..
- Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

PHY (L) 321-LAB: ELECTRICITY AND MAGNETISM**Contact Hours: 60**

Full Marks = 50 [End Semester Exam (35) Internal Assessment (15)]

Pass Mark = 20 [End Semester Exam (14)]

- To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
- To determine the specific resistance by metre bridge.
- To determine the strength of the magnetic field produced at the centre of the tangent galvanometer coil due to a current flowing in it and hence to determine horizontal component of earth's magnetic field.
- To determine the self induction of a coil and its internal resistance in an L-R circuit
- To study the a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
- To determine the resistance of a galvanometer by half deflection method.
- To determine a resistance per unit length of metre bridge wire by Carey Foster's method.
- To verify the Thevenin and Norton theorem.
- To verify series and parallel laws of resistance by Post office Box.
- To compare the emf of two cells by potentiometer.

Reference Books

- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

Course Code: PHY 331**Course Title: THERMAL PHYSICS AND STATISTICAL**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

MECHANICS**Contact Hours: 60****Full Marks = 100** [End Semester Exam (70) Internal Assessment(30)]**Pass Marks = 40** [End Semester Exam (28)]**(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)****Unit 1:Laws of Thermodynamics:**

Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermo dynamical Processes, Applications of First Law: General Relation between C_P & C_V , Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero. **(15 Lectures)**

Unit 2:Thermodynamic Potentials:

Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for $(C_P - C_V)$, C_P/C_V ,

Unit 3: Kinetic Theory of Gases:

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases. **(12 Lectures)**

Unit 4: Theory of Radiation:

Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law. **(10 Lectures)**

Unit 5: Statistical Mechanics:

Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law, Bose-Einstein distribution law, comparison of three statistics. **(11 Lectures)**

Reference Books:

- Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Heat and Thermodynamics, M.W. Zemansky and R. Dittman, 1981, McGraw Hill
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W. Sears &
- G.L. Salinger. 1988, Narosa
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications.

PHY (L) 331-LAB: THERMAL PHYSICS AND STATISTICAL MECHANICS**Contact Hours: 60****Full Marks = 50** [End Semester Exam (35) Internal Assessment (15)]**Pass Mark = 20** [End Semester Exam (14)]

1. To determine Mechanical Equivalent of Heat, J, by Joule's method.
2. To determine the specific heat of a liquid by the method of cooling.
3. To verify Stefan's law by electrical method.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the coefficient of linear expansion by suitable method.
6. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
7. To study the variation of thermo emf across two junctions of a thermocouple with temperature.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

Course Code: PHY 341
Course Title: ELEMENTS OF MODERN PHYSICS
(Credits: Theory-04, Practicals-02)

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Theory: 60 Lectures

Full Marks = 100 [End Semester Exam (70) Internal Assessment(30)]

Pass Marks = 40 [End Semester Exam (28)]

(Two questions of 14 marks will be set from each unit, one needs to be answered from each unit)

Unit 1: Planck's quantum, Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. **(8 Lectures)**

Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra. **(4 Lectures)**

Unit 2: Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle. **(9Lectures)**

Unit 3: Two slit interference experiment with photons, atoms & particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wavefunction, probabilities and normalization; Probability and probability current densities in one dimension. **(10 Lectures)**

Unit 4: One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier. **(8Lectures)**

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy. **(5 Lectures)**

Unit 5: Radioactivity: stability of nucleus; Law of radioactive decay; Mean life and half-life; decay; decay - energy released, spectrum and Pauli's prediction of neutrino; α -ray emission. **(10Lectures)**

Fission and fusion - mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions. **(6 Lectures)**

Reference Books:

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
2. Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson, 2009, PHI Learning
2. Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill
3. Quantum Physics, Berkeley Physics, Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
4. Modern Physics, R.A. Serway, C.J. Moses, and C.A. Moyer, 2005, Cengage Learning
5. Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill

GE PHY(L) 341 LAB: ELEMENTS OF MODERN PHYSICS**Contact Hours: 60****Full Marks = 50** [End Semester Exam (35) Internal Assessment (15)]**Pass Mark = 20** [End Semester Exam (14)]

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine the ionization potential of mercury.
4. To determine value of Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. To study the diffraction patterns of single and double slits using laser and measure its intensity variation using Photosensor & compare with incoherent source – Na.
8. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
9. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.
10. To setup the Millikan oil drop apparatus and determine the charge of an electron.

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers 91
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

SKILL ENHANCEMENT COURSE**Course Code: PHY 531****Course Title: ELECTRICAL CIRCUITS AND NETWORK****Contact Hours: 30**

(Theory : 30 Practical : 20 There is no CIA / Internal)

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 1 | P - 1 | T - 0 |
| Marks (CIA:ES) | 0:30 | 0:20 | - |

UNIT 1

Chapter 1: Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. (3 Lectures)

Chapter 2: Understanding Electrical Circuits: Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money. (4 Lectures)

Chapter 3: Electrical Drawing and Symbols: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. (4 Lectures)

UNIT 2

Chapter 4: Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers. (3 Lectures)

Chapter 5: Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor. (4 Lectures)

Chapter 6: Solid State Devices: resistors, inductors and capacitors. Diode and rectifiers Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources. (3 Lectures)

UNIT 3

Chapter 7: Electrical protection: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device) 4 Lectures)

Chapter 8: Electrical Wiring: Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board. (5 Lectures)

Reference Books:

A text book in Electrical Technology - B L Theraja - S Chand & Co.

A text book of Electrical Technology - A K Theraja

Performance and design of AC machines - M G Say ELBS Edn.

Course Code: PHY 541**Course Title: Electronic Instrumentation****Contact Hours: 30** (Theory : 30 Practical : 20 There is no CIA / Internal)

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 1 | P - 1 | T - 0 |
| Marks (CIA:ES) | 0:30 | 0:20 | - |

UNIT 1

Chapter 1: Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

(4 Lectures)

Chapter 2: Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance.

(5 Lectures)

UNIT 2

Chapter 3: Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.

(8 Lectures)

Chapter 4: Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis.

(3Lectures)

UNIT 3

Chapter 5: Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges.

(4 Lectures)

Chapter 6: Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.

(3Lectures)

Chapter 7: Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution.

(3 Lectures)

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment,
4. Use of Digital multimeter/VTVM for measuring voltages
5. Circuit tracing of Laboratory electronic equipment,
6. Winding a coil / transformer.
7. Study the layout of receiver circuit.
8. Trouble shooting a circuit
9. Balancing of bridges

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.

To observe the limitations of a multimeter for measuring high frequency voltage and currents.

To measure Q of a coil and its dependence on frequency, using a Q- meter.

Measurement of voltage, frequency, time period and phase angle using CRO.

Measurement of time period, frequency, average period using universal counter/ frequency counter.
Measurement of rise, fall and delay times using a CRO.
Measurement of distortion of a RF signal generator using distortion factor meter.
Measurement of R, L and C using a LCR bridge/ universal bridge.

Open Ended Experiments:

Using a Dual Trace Oscilloscope
Converting the range of a given measuring instrument (voltmeter, ammeter)

Reference Books:

A text book in Electrical Technology - B L Theraja - S Chand and Co.
Performance and design of AC machines - M G Say ELBS Edn.
Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
Logic circuit design, Shimon P. Vingron, 2012, Springer.
Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer
Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc. ZOOLOGY HONOURS

| Semester | Core Courses (14) | Ability Enhancement Compulsory Courses AEC (2) | Skill Enhancement courses SEC (2) | Discipline Specific Elective DSE (4) | Generic Elective GE (4) |
|----------|--|--|--------------------------------------|---------------------------------------|------------------------------|
| I | Non Chordates I: Protista to Pseudocoelomates | English Communication | | | Cell Biology |
| | Cell Biology | | | | |
| II | Non Chordates- II: Coelomates | Environmental Studies | | | General Physiology |
| | General Physiology | | | | |
| III | Diversity of Chordates | | Pisciculture / Aquarium Fish Keeping | | Fundamentals of Biochemistry |
| | Comparative Anatomy of Vertebrates | | | | |
| | Fundamentals of Biochemistry | | | | |
| IV | Physiology: Controlling and Coordinating Systems | | Poultry Farming / Apiculture | | Principles of Ecology |
| | Biochemistry of Metabolic Processes | | | | |
| | Principles of Ecology | | | | |
| V | Molecular Biology | | | Animal Behavior and Chronobiology | |
| | Principles of Genetics | | | Wild Life Conservation and Management | |
| VI | Developmental Biology | | | Introduction to Biotechnology | |
| | Evolutionary Biology | | | Immunology | |

| SEMESTER | COURSE OPTED | COURSE NAME | CREDITS |
|----------|---|--|---------|
| I | Ability Enhancement compulsory Course- I | English Communications | 2 |
| | Core Course -I(Theory) | Non Chordates-I Protista to Pseudocoelomates | 4 |
| | Core Course -I (Practical) | Non Chordates-I Protista to Pseudocoelomates | 2 |
| | Core Course -II (Theory) | Cell Biology | 4 |
| | Core Course -II (Practical) | Cell Biology | 2 |
| | Generic Elective -1 (Theory) | | 4 |
| | Generic Elective - 1 (Practical) | | 2 |
| II | Ability Enhancement Compulsory Course- II | Environmental Science | 2 |
| | Core Course -III (Theory) | Non Chordates II: Coelomates | 4 |
| | Core Course -III (Practical) | Non Chordates II: Coelomates | 2 |
| | Core Course -IV (Theory) | General Physiology | 4 |
| | Core Course -IV (Practical) | General Physiology | 2 |
| | Generic Elective -2 (Theory) | | 4 |
| | Generic Elective -2 (Practical) | | 2 |
| III | Core Course -V (Theory) | Diversity of Chordates | 4 |
| | Core Course -V (Practical) | Diversity of Chordates | 2 |
| | Core Course -VI (Theory) | Comparative Anatomy of Vertebrates | 4 |
| | Core Course -VI (Practical) | Comparative Anatomy of Vertebrates | 2 |
| | Core Course VII (Theory) | Fundamentals of Biochemistry | 4 |
| | Core Course -VII (Practical) | Fundamentals of Biochemistry | 2 |
| | Skill Enhancement Course- 1 | Pisciculture | 2 |
| | Generic Elective - 3 (Theory) | | 4 |
| | Generic Elective - 3 (Practical) | | 2 |
| IV | Core Course - VIII (Theory) | Physiology: Controlling and Coordinating Systems | 4 |
| | Core Course – VIII (Practical) | Physiology: Controlling and Coordinating Systems | 2 |
| | Core Course - IX (Theory) | Biochemistry of Metabolic Processes | 4 |
| | Core Course - IX (Practical) | Biochemistry of Metabolic Processes | 2 |
| | Core Course -X (Theory) | Principles of Ecology | 4 |
| | Core Course -X (Practical) | Principles of Ecology | 2 |
| | Skill Enhancement Course- 2 | Apiculture | 2 |
| | Generic Elective - 4 (Theory) | | 4 |
| | Generic Elective -4 (Practical) | | 2 |
| V | Core Course - XI (Theory) | Molecular Biology | 4 |
| | Core Course - XI (Practical) | Molecular Biology | 2 |
| | Core Course - XII (Theory) | Principles of Genetics | 4 |
| | Core Course - XII (Practical) | Principles of Genetics | 2 |
| | Discipline Specific Elective -1 (Theory) | Animal Behavior | 4 |
| | Discipline Specific Elective -1 (Practical) | Animal Behavior | 2 |
| | Discipline Specific Elective- 2 (Theory) | Wild Life Conservation | 4 |
| | Discipline Specific Elective- 2 (Practical) | Wild Life Conservation | 2 |
| VI | Core Course XIII (Theory) | Developmental Biology | 4 |
| | Core Course XIII (Practical) | Developmental Biology | 2 |
| | Core Course XIV (Theory) | Evolutionary Biology | 4 |
| | Core Course XIV (Practical) | Evolutionary Biology | 2 |
| | Discipline Specific Elective 3 (Theory) | Biotechnology | 4 |
| | Discipline Specific Elective -3 (Practical) | Biotechnology | 2 |
| | Discipline Specific Elective -4 (Theory) | Immunology | 4 |
| | Discipline Specific Elective -4 (Practical) | Immunology | 2 |

| CORE COURSES | | |
|---------------------|-----------|--|
| CC I | (ZOO 111) | Non Chordates-I Protista to Pseudocoelomates |
| CC II | (ZOO 112) | Cell Biology |
| CCIII | (ZOO121) | Non Chordates II: Coelomates |
| CC IV | (ZOO 122) | General Physiology |
| CC V | (ZOO 131) | Diversity of Chordates |
| CC VI | (ZOO132) | Comparative Anatomy of Vertebrates |
| CC VII | (ZOO 133) | Fundamentals of Biochemistry |
| CC VIII | (ZOO 141) | Physiology: Controlling and Coordinating Systems |
| CC IX | (ZOO 142) | Biochemistry of Metabolic Processes |
| CC X | (ZOO 143) | Principles of Ecology |
| CC XI | (ZOO 151) | Molecular Biology |
| CC XII | (ZOO 152) | Principles of Genetics |
| CC XIII | (ZOO 161) | Developmental Biology |
| CC IV | (ZOO162) | Evolutionary Biology |

| GENERIC ELECTIVE COURSES | | |
|---------------------------------|-----------|------------------------------|
| GE 1 | (ZOO 311) | Cell Biology |
| GE 2 | (ZOO 321) | General Physiology |
| GE 3 | (ZOO 331) | Fundamentals of Biochemistry |
| GE 4 | (ZOO 341) | Principles of Ecology |

| DISCIPLINE ELECTIVE COURSES | | |
|------------------------------------|-----------|---------------------------------------|
| DSE 1 | (ZOO 251) | Animal Behavior and Chronobiology |
| DSE 2 | (ZOO 252) | Wild Life Conservation and Management |
| DSE 3 | (ZOO 261) | Introduction to Biotechnology |
| DSE 4 | (ZOO 262) | Immunology |

| SKILL ENHANCEMENT COURSES | | |
|----------------------------------|-----------|--------------------------------------|
| SEC 1 | (ZOO 531) | Pisciculture / Aquarium Fish Keeping |
| SEC 2 | (ZOO 541) | Poultry Farming / Apiculture |

I. CORE COURSE (CC)

Course Code: ZOO 111

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Title: NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

THEORY**(Credits 4)****Unit 1: Protista****(13 Lectures)**

General Characteristics and classification upto classes; Life cycle and pathogenicity of *Plasmodium vivax*; Nutrition, Locomotion and Reproduction in Protista.

Unit 2: Porifera**(7 Lectures)**

General characteristics and Classification up to classes; Canal system in sponges

Unit 3: Cnidaria and Ctenophora**(16 Lectures)**

General characteristics and Classification up to classes; Metagenesis in *Obelia*; Polymorphism in Cnidaria; Corals and coral reefs
General characteristics and Evolutionary significance

Unit 4: Platyhelminthes**(10 Lectures)**

General characteristics and Classification up to classes; Life cycle and pathogenicity of *Fasciola hepatica* and *Taenia solium*

Unit 5: Nematelminthes**(14 Lectures)**

General characteristics and Classification up to classes; Life cycle and pathogenicity of *Ascaris lumbricoides* and *Wuchereria bancrofti*; Parasitic adaptations in helminthes;

PRACTICAL**(Credits 2)****ZOO(I) 111 LAB: NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES**

1. Study of whole mount of *Euglena*, *Amoeba* and *Paramecium*; Binary fission and Conjugation in *Paramecium*
2. Examination of pond water collected from different places for diversity in protista
3. Study of *Sycon* (T.S. and L.S.)
4. Study of *Obelia*, *Physalia*, *Aurelia*, *Metridium*,
5. One specimen/slide of any ctenophore
6. Study of adult *Fasciola hepatica*, *Taenia solium* and their life cycles (Slides/microphotographs)
7. Study of adult *Ascaris lumbricoides*
8. To submit a Project Report on any related topic on life cycles/coral/ coral reefs.

SUGGESTED READINGS

Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition. Holt Saunders International Edition.
Jordan, E.L and Verma, P.S, (2009) *Invertebrate Zoology*, IV Edition. S. Chand and Company.
Kotpal, R.L. *Modern Text Book of Zoology: Invertebrates*, IX Edition, Rastogi Publications.

Course Code: **ZOO 112**
 Course Title: **CELL BIOLOGY**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)

Unit 1: Overview of Cells and Plasma Membrane

Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions. Various models of plasma membrane structure, Transport across membranes: Active and Passive transport, Facilitated transport, Cell junctions: Tight junctions, Desmosomes, Gap junctions

Unit 2: Endomembrane System

Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes

Unit 3: Mitochondria, Peroxisomes and Cytoskeleton

Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Peroxisomes

Cytoskeleton: Structure and Functions: Microtubules, Microfilaments and Intermediate filaments

Unit 4: Nucleus

Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus; Chromosomal DNA and its packaging

Unit 5: Cell Division, Cell signaling, Apoptosis and Cancer. Mitosis, Meiosis, Cell cycle and its regulation. Cell Signaling GPCR and Role of second messenger (cAMP). Apoptosis: Extrinsic (Death Receptor) Pathway and Intrinsic (Mitochondrial) Pathway
 Cancer, Growth and Development,

PRACTICAL

(Credits 2)

ZOO(L) 112 LAB: CELL BIOLOGY

1. Gram's staining to study Prokaryotic cells.
2. Study of various stages of mitosis by permanent slides.
3. Preparation of temporary, stained squash of onion root tip to study various stages of mitosis
4. Study of various stages of meiosis.
5. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.
6. Preparation of permanent slide to demonstrate:
 - i. DNA by Feulgen reaction
 - ii. DNA and RNA by MGP
 - iii. Mucopolysaccharides by PAS reaction
 - iv. Proteins by Mercurobromophenol blue/Fast Green

SUGGESTED READINGS

- Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Cooper, G.M. and Hausman, R.E. (2009). *The Cell: A Molecular Approach*. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Gupta, P.K (2006) *Cell and Molecular Biology*, Rastogi Publications
- Powar, C.B (2013). *Molecular and Cell Biology*, III Edition, Himalaya Publishing House Pvt. Ltd.

Course Code: ZOO 121
Course Title: NON-CHORDATES II: COELOMATES

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY (Credits 4)

Unit 1: Introduction to Coelomates (8 Classes)

Coelom: Types, significance and evolution; Metamerism, significance and evolution.

Unit 2: Annelida & Onychophora (15 Classes)

General characteristics and Classification up to classes; Excretion in Annelida ; General characteristics and Evolutionary significance of Onychophora.

Unit 3: Arthropoda (10 Classes)

General characteristics and Classification up to classes ; Vision and Respiration in Arthropoda ; Metamorphosis in Insects.

Unit 4: Mollusca (12 Classes)

General characteristics and Classification up to classes; Respiration in Mollusca; Torsion and detorsion in Gastropoda; Pearl formation in bivalves; Evolutionary significance of tro- chophore larva.

Unit 5: Echinodermata (15 Classes)

General characteristics and Classification up to classes; Water-vascular system in Aster-oidea; Larval forms in Echinodermata; Affinities with Chordates.

PRACTICAL (Credits 2)

ZOO(L) 121 LAB: NON-CHORDATES II: COELOMATES

1. Study of following specimens:
2. Annelids - *Nereis*, *Pheretima*, *Hirudinaria*
3. Arthropods - *Palamnaeus*, *Palaemon*, *Daphnia*, *Cancer*, *Scolopendra*, *Julus*, *Bombyx*, *Periplaneta*, termites and honey bees
4. Onychophora - *Peripatus*
5. Molluscs - *Pila*, *Unio*, *Sepia*, *Octopus*, *Nautilus*
6. Echinodermates - *Asterias*, *Clypeaster*, *Echinus*, *Cucumaria* and *Antedon*
7. Study of digestive system & nervous system of earthworm
8. T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm
9. Mount of mouth parts and dissection of digestive system and nervous system of *Periplaneta*
10. To submit a Project Report on any related topic to larval forms of insects

SUGGESTED READINGS

Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition. Holt Saunders International Edition
 Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
 Jordan, E.L and Verma, P.S, (2009) *Invertebrate Zoology*, IV Edition. S. Chand and Company.
 Kotpal, R.L. *Modern Text Book of Zoology: Invertebrates*, IX Edition, Rastogi Publications.

Course Code: ZOO 122
Course Title: GENERAL PHYSIOLOGY THEORY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

(Credits 4)
(15 classes)

Unit 1: Physiology of Digestion
 Structural organization and functions of gastrointestinal tract and associated glands; Digestion of proteins, carbohydrates and fats; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal control of secretion of enzymes in Gastrointestinal tract.

Unit 2: Physiology of Respiration (14 classes)

Mechanism of respiration, Pulmonary ventilation; Respiratory capacity, Respiratory pigments, Transport of oxygen and carbon dioxide in blood; Oxygen Haemoglobin Dissociation curve, Carbon monoxide poisoning; Regulation of respiration.

Unit 3: Renal Physiology (10 classes)

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance & acid-base balance, kidney failure management.

Unit 4: Circulatory System (15 classes)

Structure of mammalian heart; Cardiac cycle, Pace maker; Components of blood and their functions; Structure and functions of haemoglobin, Haemopoiesis, Blood clotting mechanism and pathways, ABO blood groups, Rh factor and MN group.

Unit 5: Reproductive System (6 classes)

Histology and functions of testis and ovary, methods of contraception in male and female.

PRACTICALS (Credits 2)

ZOO(L) 122 LAB:GENERAL PHYSIOLOGY

1. Determination of ABO blood group & Rh factor
2. Enumeration of Red blood cells (RBC) using haemocytometer
3. Enumeration of White blood cells (WBC) using haemocytometer
4. Estimation of haemoglobin concentration using haemoglobinometer
5. Preparation of haemin crystals
6. Recording of blood pressure using a sphygmomanometer
7. Study of permanent slides of mammalian testis and ovary.

SUGGESTED READINGS

- Guyton, A.C. & Hall, J.E. (2006). *Textbook of Medical Physiology*. XI Edition. Herculat Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). *Principles of Anatomy & Physiology*. XI Edition John Wiley & sons, correlations. XII Edition. Lippincott W. & Wilkins.
- Arey, L.B. (1974). *Human Histology*. IV Edition. W.B. Saunders.
- Vander A, Sherman J. and Luciano D. (2014). *Vander's Human Physiology: The Mechanism of Body Function*. XIII Edition, Mcgraw Hills

Course Code: **ZOO 131**
 Course Title: **DIVERSITY OF CHORDATA**

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)

Unit 1: Introduction to Protochordata and Chordata

(10 Lectures)

General characteristics of Hemichordata, Urochordata and Cephalochordata; Retrogressive metamorphosis in Urochordata.

General characteristics and outline classification of Chordata.

Unit 2: Origin of Chordata and Agnatha

(10 Lectures)

Dipleurula concept and the Echinoderm theory of origin of chordates; Advanced features of vertebrates over Protochordates.

General characteristics and classification of cyclostomes up to class.

Unit 3: Pisces and Amphibia

(13 Lectures)

General characteristics of Chondrichthyes and Osteichthyes, Classification up to order; Migration, Osmoregulation and Parental care in fishes.

Amphibians: General characteristics and classification up to order; Evolution of terrestrial ectotherms; Neoteny in Urodela.

Unit 4: Reptilia and Aves

(15 Lectures)

General characteristics and classification up to order ; Poison apparatus and Biting mechanism in snakes.

General characteristics and classification up to order; Archaeopteryx- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds.

Unit 5: Mammals and Zoogeography

(12 Lectures)

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages.

Zoogeographical realms, Theories pertaining to distribution of animals.

PRACTICAL

(Credits 2)

ZOO(L) 131 LAB: DIVERSITY OF CHORDATA

1. Study of museum Specimen:

Protochordata: *Balanoglossus*, *Amphioxus*,

Agnatha: *Petromyzon*,

Pisces: *Scoliodon*, *Torpedo*, *Heteropneustes*, *Labeo*, *Anguilla*,

Amphibia : *Ichthyophis*, *Bufo*, *Hyla*, *Alytes*, *Salamandra*,

Reptilia: *Hemidactylus*, *Varanus*, *Calotes*, *Bungarus*, *Vipera*, *Naja*,

Mammalia: Bat (Insectivorous and Frugivorous), *Funambulus*,

2. Key for Identification of poisonous and non-poisonous snakes

3. Study of Types of beaks of birds

4. Power point presentation on study of any two animals from two different classes by students (may be included if dissections not given permission) Classification from Young, J. Z. (2004) to be followed

SUGGESTED READINGS

- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub. Co.
- Hall B.K. and Hallgrimsson B. (2008). *Strickeberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.
- Kotpal R.L. Modern Textbook of Zoology: Vertebrate Rastogi Publication.

Course Code: ZOO 132

Course Title: COMPARATIVE ANATOMY OF VERTEBRATES

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY (Credits 4)

Unit 1: Integumentary System and Skeleton System

Structure, functions and derivatives of integument.

Overview of axial and appendicular skeleton, Jaw suspensorium.

Unit 2: Digestive System and Respiratory system

Alimentary canal and associated glands, dentition.

Skin, gills, lungs and air sacs; Accessory respiratory organs.

Unit 3: Circulatory System and Urinogenital System

General plan of circulation, evolution of heart and aortic arches.

Urinogenital System Succession of kidney, Evolution of urinogenital ducts.

Unit 4: Nervous System

Comparative account of brain, Autonomic, Central and Peripheral Nervous system.

Unit 5: Sense Organs

Classification of receptors; Brief account of visual and auditory receptors in man.

PRACTICAL

(Credits 2)

ZOO(L) 132 LAB: COMPARATIVE ANATOMY OF VERTEBRATES

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs
2. Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit
3. Mammalian skulls: One herbivorous and one carnivorous animal
4. Dissection of rat to study arterial and urinogenital system(subject to permission)
5. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)
6. Project on skeletal modifications in vertebrates (may be included if dissection not permitted)

SUGGESTED READINGS

- Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Functions and Evolution*. IV Edition. McGraw-Hill Higher Education
- Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies
- Weichert C.K and William Presch (1970). *Elements of Chordate Anatomy*, Tata McGraw Hills
- Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons
- Walter, H.E. and Sayles, L.P. *Biology of Vertebrates*, Khosla Publishing House

Course Code: **ZOO 133**
 Course Title: **FUNDAMENTALS OF BIOCHEMISTRY**

| | | | |
|-------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)

Unit 1: Carbohydrates

(12 Classes)

Definition, classification and structure of carbohydrates; Glycoconjugates

Unit 2: Proteins

(14 Classes)

Structure and Classification of amino acids; Amino acid as buffer; Iso-electric pH of amino acids; Physiological importance of essential and nonessential amino acids.

Various levels of organization in proteins with examples; Introduction to simple and conjugated proteins.

Unit 3: Lipids

(12 Classes)

Definition, classification and structure of fatty acids; Classification and structure of lipids; Steroids.

Unit 4: Nucleic Acids

(10 Classes)

Structure and chemical composition of DNA and RNA; Types of DNA; Nucleosides and Nucleotides; C₀t curve; Hypo- and Hyperchromaticity of DNA.

Unit 5: Enzymes

(12 Classes)

Definition and classification of enzyme; Mechanism of enzyme action; Factors affecting rate of enzyme-catalyzed reactions; Enzyme kinetics in reference to the concept of Michaelis-Menten's equation, K_m and V_{max}; Multi-substrate reactions; Isozymes; Enzyme inhibition; Regulation of enzyme action.

PRACTICAL

(Credits 2)

ZOO(L) 133 LAB: FUNDAMENTALS OF BIOCHEMISTRY

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Identification of amino acids by paper chromatography
3. Effect of pH, temperature and inhibitors on the action of salivary amylase.
4. Demonstration of proteins separation by SDS-PAGE.

SUGGESTED READING

- Cox, M.M and Nelson, D.L. (2008t). *Lehninger's Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw - Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). *Molecular Biology of the Gene*, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

Course Code: ZOO 141

Course Title: PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

THEORY (Credits 4)

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Unit 1: Tissues, bone and cartilage

Structure, location, classification and functions of epithelial tissue, connective tissue, muscular Structure and types of bones and cartilages, Ossification, bone growth and resorption.

Unit 2: Nervous System

Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc.

Unit 3: Muscle

Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus.

Unit 4: Circulatory System

Blood Clotting System- Kallikrein-Kininogen System, Complement system and Fibrinolytic System; Cardiac cycle and cardiac output; Frank Starling Law of the heart; Heart rate and its regulation; Electrocardiogram, Blood Pressure and its regulation.

Unit 5: Endocrine System

Structure and function of endocrine glands, Hypothalamic- Hypophyseal portal system, Classification of hormones; Regulation of their secretion; Mode of hormone action, Placental hormones.

PRACTICALS

(Credits 2)

ZOO(L) 141 LAB: PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

1. Recording of simple muscle twitch with electrical stimulation (or Virtual)
2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)
3. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres.
4. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Adrenal, Thyroid and Parathyroid
5. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues (*Subject to UGC guidelines)

SUGGESTED READINGS

- Guyton, A.C. & Hall, J.E. (2006). *Textbook of Medical Physiology*. XI Edition. Herculat Asia PTE Ltd. /W.B. Saunders Company
- Tortora, G.J. & Grabowski, S. (2006). *Principles of Anatomy & Physiology*. XI Edition John Wiley & sons
- Victor P. Eroschenko. (2008). *diFiore's Atlas of Histology with Functional correlations*. XII Edition. Lippincott W. & Wilkins.
- Arey, L.B. (1974). *Human Histology*. IV Edition. W.B. Saunders.

Course Code: ZOO 142
Course Title: BIOCHEMISTRY OF METABOLIC PROCESSES

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)

Unit 1: Carbohydrate Metabolism

(20 Classes)

Glycolysis; Citric acid cycle; Pentose phosphate pathway; Gluconeogenesis; Glycogenolysis.

Unit 2: Protein Metabolism

(12 Classes)

Transamination and Deamination; Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids.

Unit 3: Lipid Metabolism

(12 Classes)

β -oxidation of saturated and unsaturated fatty acids; Biosynthesis of palmitic acid.

Unit 4: Oxidative Phosphorylation

(8 Classes)

Redox systems; Mitochondrial respiratory chain; Inhibitors and un-couplers of Electron Transport System.

Unit 5: Overview of Metabolism

(8 Classes)

ATP as "Energy Currency of cell"; Coupled reactions; Cofactors; Intermediary metabolism and regulatory mechanisms.

PRACTICAL

(Credits 2)

ZOO(L) 142 LAB: BIOCHEMISTRY OF METABOLIC PROCESS

1. Estimation of the amount of protein in given sample by colorimetry
2. Estimation of the amount of Ascorbic acid in given sample.
3. Estimation of the effect of Urea concentration on the activity of Urease & to find its K_m .
4. Estimation of the amount of PO_4^{3-} present in the given sample.

SUGGESTED READINGS

- Cox, M.M and Nelson, D.L. (2008t). *Lehninger's Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). *Molecular Biology of the Gene*, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

Course Code: ZOO 143
Course Title: PRINCIPLES OF ECOLOGY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)

Unit 1: Introduction to Ecology

(12 Classes)

History of ecology; Autecology and synecology; Levels of organization; Laws of limiting factors; Study of physical factors.

Unit 2: Population

(15 Classes)

Population Ecology; Unique and group attributes of population: Density, natality, mortality, fecundity, life tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic growth.

Population regulation: density-dependent and independent factors, Population Interactions, Gause's principle with laboratory and field examples, Lotka-Volterra Predator-Prey Model.

Unit 3: Community

(10 Classes)

Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example; Theories pertaining to climax community.

Unit 4: Ecosystem

(12 Classes)

Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with one example of Nitrogen cycle; Human modified ecosystem.

Unit 5: Pollution

(11 Classes)

Types of pollution, Causes, effect and control of Air, Water and Soil Pollution; Pesticides: Mode of transport, Bioconcentration, Bioaccumulation Biomagnification and Biotransformation.

PRACTICALS

(Credits 2)

ZOO(L) 143 LAB: PRINCIPLES OF ECOLOGY

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided.
2. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community.
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, temperature, turbidity/
4. penetration of light, determination of pH, and Dissolved Oxygen and free CO₂.

SUGGESTED READINGS

- *Colinvaux, P. A. (1993). Ecology. II Edition.*
- *Wiley, John and Sons, Inc. Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.*
- *Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition.*
- *Brooks/Cole Robert Leo Smith. Ecology and field biology. Harper and Row publisher*
- *Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres*

Course Code: ZOO 151
Course Title: MOLECULAR BIOLOGY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)

Unit 1: Nucleic Acids

Salient features of DNA and RNA, Watson and Crick model of DNA, Nucleosome

Unit 2: DNA Replication

DNA Replication, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of linear ds-DNA, Replication Inhibitors, DNA Repair Mechanism

Unit 3: Transcription, Post Transcriptional Modifications and Processing of RNA

RNA polymerase and transcription Unit, mechanism of transcription, synthesis of rRNA and mRNA, transcription factors, Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism; RNA editing, Processing of tRNA, Transcriptional Inhibitors, Ribozyme

Unit 4: Translation

Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis, Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Inhibitors of protein synthesis, Translational Inhibitors

Unit 5: Gene Regulation

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from *Lac* operon and *trp* operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting

PRACTICAL

(Credits 2)

ZOO(L) 151 LAB: MOLECULAR BIOLOGY

1. Study of Polytene chromosomes from Chironomous / *Drosophila* larvae
2. Estimation of the growth kinetics of *E. coli* by turbidity method
3. Quantitative estimation of salmon sperm/calf thymus DNA using colorimeter (Diphenylamine reagent) or spectrophotometer (A₂₆₀ measurement)
4. Study and interpretation of electron micrographs/ photograph showing
 - a. DNA replication
 - b. Transcription
 - c. Split genes

SUGGESTED READINGS

- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). *The World of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: *Molecular Biology of the Cell*, IV Edition.
- Cooper G. M. and Robert E. Hausman R. E. *The Cell: A Molecular Approach*, V Edition, ASM Press and Sinauer Associates.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Karp, G. (2010) *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc. Lewin B. (2008). *Gene* XI, Jones and Bartlett
- McLennan A., Bates A., Turner, P. and White M. (2015). *Molecular Biology* IV Edition. GS, Taylor and Francis Group, New York and London.

Course Code: ZOO 152
Course Title: PRINCIPLES OF GENETICS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)

Unit 1: Mendelian Genetics and its Extension (14 Classes)

Laws of Mendel; Back cross; Test cross; Pleiotropism; Bateson factor hypothesis, Multiple alleles. Intra-allelic interaction: Incomplete dominance, Codominance, Lethal interaction, Superdominance; Inter-allelic interaction: Epistasis, Complementary and Supplementary interaction.

Unit 2: Linkage and Crossing Over (12 Classes)

Definition and types of Linkage, Chromosomal theory of linkage; Definition and cytological basis of crossing over, Molecular mechanisms of crossing over, Two factor and three factor crosses; Interference and coincidence.

Unit 3: Determination of sex, Sex linked inheritance and Polygenic inheritance (12 Classes)

Chromosomal and Genic-balance mechanism of sex determination. Hormonal influence on sex determination; Sex linked, sex limited and sex influenced trait; Polygenic inheritance.

Unit 4: Mutations (12 Classes)

Definition and classification of Chromosomal and Gene mutations; Physical and chemical mutagens, Detection of mutations by CLB method; Genetic diseases in reference to Down's syndrome, Klinefelter's syndrome and Turner's syndrome.

Unit 5: Extra chromosomal inheritance and Transposable Genetic Elements (10 Classes)

Definition of extra-chromosomal inheritance, Infective heredity in Paramecium, Antibiotic resistance in Chlamydomonas and Plasmids.

Definition and classes of transposons, Transposons in bacteria, Ac-Ds elements in maize and Transposons in humans.

PRACTICALS

(Credits 2)

ZOO(L) 152 LAB: PRINCIPLES OF GENETICS

1. Simple numerals based on number and genotype of gametes and offsprings in various genetical crosses.
2. Calculations based on intra-allelic and inter-allelic gene interaction.
3. Construction of linkage-map or Assessment of order of genes by two-point and three-point test crosses of a given genetical crosses.
4. Chi-square analysis of a given data to accept or reject a hypothetical genetical ratio.

SUGGESTED READINGS

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics. VIII Edition. Wiley India*
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics. V Edition. John Wiley and Sons Inc*
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics. X Edition. Benjamin Cummings*
- Russell, P. J. (2009). *Genetics- A Molecular Approach. III Edition. Benjamin Cummings*
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co*
- Fletcher H. and Hickey I. (2015). *Genetics. IV Edition. GS, Taylor and Francis Group, New York and London.*

Course Code: ZOO 161
Course Title: DEVELOPMENTAL BIOLOGY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)

Unit 1: Introduction

(10 Classes)

Basic concept of developmental biology, Epigenesis, Baer's law, Biogenic law, Mosaic and Regulative Development.

Unit 2: Early Embryonic Development

(15 Classes)

Gametogenesis: Spermatogenesis and Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal); Blocks to polyspermy; Planes and patterns of cleavage; Early development of frog and chick up to gastrulation; Fate Maps; Embryonic induction and organizers.

Unit 3: Late Embryonic Development

(14 Classes)

Organogenesis with special reference to brain in mammals; Extra-embryonic membranes in birds and mammals; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta).

Unit 4: Post Embryonic Development

(12 Classes)

Metamorphosis: Changes, hormonal regulations in amphibians and insects;
 Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each).
 Ageing: Concepts and Theories.

Unit 5: Implications of Developmental Biology

(9 Classes)

Teratogenesis: Teratogenic agents and their effects on embryonic development; In vitro fertilization, Embryonic stem cell (ESC), Amniocentesis.

PRACTICAL

(Credits 2)

ZOO(L) 161 LAB: DEVELOPMENTAL BIOLOGY

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages: blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)
2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)
3. Preparation of whole mount for Chick embryo (Various stages of development).
4. Study of the developmental stages and life cycle of any insect from stock culture
5. Study of different types of placenta from photographs

SUGGESTED READINGS

- Gilbert, S. F. (2010). *Developmental Biology*, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA
- Balinsky B. I. and Fabian B. C. (1981). *An Introduction to Embryology*, V Edition, International Thompson Computer Press
- Carlson, R. F. *Patten's Foundations of Embryology*
- Kalthoff (2008). *Analysis of Biological Development*, II Edition, McGraw-Hill Publishers
- Lewis Wolpert (2002). *Principles of Development*. II Edition, Oxford University Press

Course Code: ZOO 162
Course Title: EVOLUTIONARY BIOLOGY

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)

Unit 1: Origin of life and Theories of Evolution.

(10 Classes)

Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes. Lamarckism, Darwinism, Neo-Darwinism.

Unit 2: Evidences of Evolution.

(10 Classes)

Evidences of organic evolution, Fossils, dating of fossils, geological time scale, Molecular evidences (universality of genetic code), three domains of life, molecular clock, globin gene family.

Unit 3: Process of evolutionary change, Species concept.

(15 Classes)

Organic variations, Isolating mechanisms, Natural selection (examples: Industrial melanism, Pesticide resistance), Types of natural selection (Directional, Stabilizing, Disruptive), Sexual selection, Artificial Selection.

Macro Evolutionary Principles (Darwin's Finches), Convergence, Divergence and parallelism

Biological species concept, Sibling species, Polymorphic species, Polytypic Species, Modes of speciation (Allopatric and Sympatric).

Unit 4: Principles of Population genetics and Extinctions.

(15 Classes)

Concept of gene pool, Gene frequencies, Hardy-Weinberg Law; Evolutionary forces upsetting H-W equilibrium, Genetic drift (mechanism, founder's effect, bottleneck phenomenon), Role of migration and mutation in changing allele frequencies.

Extinctions- Back ground and mass extinctions (causes and effects), detailed example of K-T extinction.

Unit 5: Origin, evolution of man and Phylogenetic Trees.

(10 Classes)

Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to Homo sapiens Phylogenetic trees and interpretation.

PRACTICAL

(Credits 2)

ZOO(L) 162 LAB: EVOLUTIONARY BIOLOGY

1. Study of fossils from models/ pictures
2. Study of homology and analogy from suitable specimens
3. Study and verification of Hardy-Weinberg Law by chi square analysis
4. Demonstration of role of natural selection and genetic drift in changing allele frequencies using simulation studies
5. Graphical representation and interpretation of data of height/ weight of a sample of 100 humans in relation to their age and sex.
6. Construction of phylogenetic trees with the help of bioinformatics tools (Clustal X, Phylip, NJ) and its interpretation.

SUGGESTED READINGS

- Ridley, M (2004) *Evolution*. III Edition Blackwell publishing
- Hall, B.K. and Hallgrimson, B (2008). *Evolution IV Edition*. Jones and Barlett Publishers.
- Campbell, N.A. and Reece J.B (2011). *Biology*. IX Edition. Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.
- Snustad, D.P., Simmons, M.J (2009) . *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
- Pevsner, J (2009). *Bioinformatics and Functional Genomics*. II Edition Wiley Blackwell
- Minkoff, E. (1983). *Evolutionary Biology*. Addison-Wesley.

II. DISCIPLINE SPECIFIC ELECTIVE COURSES

Course Code: ZOO 251

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Title: ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

THEORY

(Credits 4)

Unit 1: Introduction to Animal Behaviour and Mechanisms of behavior.

Origin and history of Ethology; Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of behaviour, Methods and recording of a behaviour

Unit 2: Patterns of Behaviour

Stereotyped Behaviours (Orientation, Reflexes), Individual Behavioural patterns; Instinct and Learnt Behaviour; Associative learning, classical and operant conditioning, Habituation, Imprinting.

Unit 3: Social Behaviour:

Concept of Society, Social hierarchy (with special reference to honey bees), Territoriality, Communication and the senses; Altruism.

Unit 4: Sexual Behaviour:

Asymmetry of sex, Mate choice, Sexual conflict in parental care, Pheromones.

Unit 5: Chronobiology:

Biological Rhythm: Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms; Concept of Zeitgebers; Circannual rhythms; Role of melatonin.

PRACTICAL

(Credits 2)

ZOO(L)251 LAB: ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

- To study nests and nesting habits of the birds and social insects.
- To study the behavioural responses of wood lice to dry and humid conditions.
- To study geotaxis behaviour in earthworm.
- To study the phototaxis behaviour in insect larvae.
- Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.
- Study and actogram construction of locomotor activity of suitable animal models.
- Study of circadian functions in humans (daily eating, sleep and temperature patterns).

SUGGESTED READINGS

- David McFarland, *Animal Behaviour*, Pitman Publishing Limited, London, UK.
- Manning, A. and Dawkins, M. S, *An Introduction to Animal Behaviour*, Cambridge, University Press, UK.
- John Alcock, *Animal Behaviour*, Sinauer Associate Inc., USA.
- Paul W. Sherman and John Alcock, *Exploring Animal Behaviour*, Sinauer Associate Inc., Massachusetts, USA.

Course Code: ZOO 252

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Title: WILD LIFE CONSERVATION AND MANAGEMENT

THEORY**(Credits 4)****Unit 1: Introduction to Wild Life****(12 Classes)**

Values of wild life: positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.

Unit 2: Evaluation and management of wild life.**(12 Classes)**

Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedures: Remote sensing and GIS.

Unit 3: Management of habitats**(10 Classes)**

Setting back succession; Grazing, logging; Mechanical treatment; Cover construction; Preservation of general genetic diversity.

Unit 4: Management planning of wild life in protected areas**(13 Classes)**

Ecotourism/wild life tourism in forests; Concept of climax persistence; Ecology of perturbation. Management of excess population: Bio-telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal

Unit 5: Protected areas**(13 Classes)**

National parks & Sanctuaries, Biosphere reserve, Community reserve; Important features of protected areas in India; Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve.

PRACTICALS**(Credits 2)****ZOO(L) 252 LAB: WILD LIFE CONSERVATION AND MANAGEMENT**

1. Identification of flora, mammalian fauna, avian fauna, herpeto-fauna
2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)
3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.
4. Demonstration of different field techniques for flora and fauna ground cover assessment, Tree canopy cover assessment, Shrub cover assessment.
6. T rail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences)

SUGGESTED READINGS

- *Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.*
- *Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflict or Coexistence? Cambridge University.*
- *Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5th edition. The Wildlife Society, Allen Press.*
- *Sutherland, W.J. (2000). The Conservation Handbook: Research, Management and Policy. Blackwell Sciences*
- *Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.*
- *Reena Mathur, Wildlife Management and conservation, 1st Edition Rastogi Publication.*

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Code: ZOO 261

Course Title: INTRODUCTION TO BIOTECHNOLOGY

THEORY

(Credits 4)

Unit 1. Introduction and Recombinant DNA Technology –I

(12 Classes)

Definition of biotechnology; Definition, nomenclature and types of restriction enzyme; Cloning vectors with a special emphasis on Plasmids, Cosmids, Phagemids, Lambda Bacteriophage and YAC vector; Expression vector; Construction of genomic libraries.

Unit 2. Recombinant DNA Technology – II

(18 Classes)

Southern, Northern and Western hybridization techniques; Sanger's method of DNA sequencing; Polymerase Chain Reaction; DNA Finger Printing.

Unit 3. Genetically Modified Organisms

(12 Classes)

Production of cloned and transgenic animals by Nuclear Transplantation, Calcium chloride method, electroporation and DNA microinjection.

Applications of transgenic animals in Production of pharmaceuticals; Knock out mice.

Applications of transgenesis in production of insect resistant plants.

Unit 4. Culture Techniques and Applications

(12 Classes)

Animal cell and tissue culture: Substrate for cell growth; Culture media; Cell culture for production of vaccines and interferons; Tissue culture of embryonic organs.

Biotechnology in medicine: Animal and human health care; Gene therapy.

Unit 5: Patents and Ethical Laws Associated with Biotechnology

(6 Classes)

Introduction to concept of patents; Evaluation of the public concerns and risks associated with biotechnology; Ethical issues of Biotechnology.

PRACTICAL

(Credits 2)

ZOO(L) 261 LAB: ANIMAL BIOTECHNOLOGY

1. Isolation of Genomic DNA.
2. Restriction digestion of DNA.
3. Hands on training for various techniques of biotechnology in NRCM (National research center on Mithun), Nagaland.
4. Seminar presentation on selective topic on biotechnology.

SUGGESTED READINGS

- *Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.*
- *Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA.*
- *Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.*
- *Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.*
- *Watson, J.D., Myers, R.M., Cauchy, A. and Witkowski, J.K. (2007). Recombinant DNA- Genes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y., USA.*
- *Beauchamp, T.I. and Childress, J.F. (2008). Principles of Biomedical Ethics. VI Edition, Oxford University Press.*

Course Code: ZOO 262
Course Title: IMMUNOLOGY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)
(14 classes)

Unit 1: Overview of Immune System

Cells and organs of the Immune system

Innate and Adaptive Immunity : Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral);

Passive: Artificial and natural Immunity; Active: Artificial and natural Immunity,

Immune dysfunctions (brief account of autoimmunity with reference to Rheumatoid Arthritis and tolerance, AIDS).

Unit 2: Antigens

(12 classes)

Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, Epitopes.

Unit 3: Immunoglobulins

(14 classes)

Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions, Immunoassays (ELISA and RIA), monoclonal antibodies, Polyclonal sera, Hybridoma technology.

Unit 4: Major Histocompatibility Complex

(10 classes)

Structure and functions of MHC molecules and CD receptors,

Antigen presenting cells: Endogenous and exogenous pathways of antigen processing and presentation.

Cytokines: Properties and functions of cytokines, Therapeutics Cytokines.

Unit 5: Complement System, Hypersensitivity and Vaccines

(10 classes)

Components and pathways of complement activation.

Hypersensitivity: brief description of various types of hypersensitivities, Vaccines: Various types of vaccines.

PRACTICAL

(Credits 2)

ZOO(L) 262 LAB: IMMUNOLOGY

1. Demonstration of lymphoid organs.
2. Histological study of spleen, thymus and lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells.
4. Cell counting and viability test from splenocytes of farm bred animals/cell lines.
5. Demonstration of a. ELISA b. Immunoelectrophoresis * The experiments can be performed depending upon usage of animals in UG courses.

SUGGESTED READINGS

- Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Freeman and Company.
- David, M., Jonathan, B., David, R. B. and Ivan R. (2006). *Immunology*, VII Edition, Mosby, Elsevier Publication.
- Abbas, K. Abul and Lichtman H. Andrew (2003.) *Cellular and Molecular Immunology*. V Edition. Saunders Publication.

III. GENERIC ELECTIVE COURSES (GEC)

Course Code: ZOO 311
Course Title: CELL BIOLOGY

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)
(15 Classes)

Unit 1: Overview of Cells and Plasma Membrane

Prokaryotic and Eukaryotic cells, Virus, prions, Mycoplasma

Structure and functions of plasma membrane structure; Transport of small molecules across membranes.

Unit 2: Cellular Organelles

(10 Classes)

Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes, Ribosomes, Mitochondria, Nucleus, Nucleolus.

Unit 3: Cytoskeleton and Chromosome

(15 Classes)

Cytoskeleton: Structure and functions, Microtubules, Microfilaments, Intermediate filaments; Chromosome: Structure and functions, Special types of chromosomes (Polytene, Lampbrush and Super-numerary chromosomes).

Unit 4: Cell division and Cell Cycle

(10 Classes)

Mitosis, Meiosis, Cell cycle and its regulation.

Unit 5: Cell signaling, Apoptosis and Cancer

(10 Classes)

Cell signaling: GPCR and role of second messenger (cAMP).

Apoptosis: Extrinsic and Intrinsic Pathways.

Cancer: Growth and Development.

PRACTICAL

(Credits 2)

ZOO(L) 311 LAB: CELL BIOLOGY

1. Study of various stages of Mitosis and Meiosis through permanent slides.
2. Preparation of temporary, stained squash of onion root tip and study of various stages of mitosis
3. Gram's staining technique for visualization of Prokaryotic cell
4. Giant chromosome staining and visualization.

SUGGESTED READINGS

- Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Cooper, G.M. and Hausman, R.E. (2009). *The Cell: A Molecular Approach*. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Gupta, P.K. (2006). *Cell and Molecular Biology*. Rastogi Publications. New Delhi
- Pomar, C.B. (2013) *Molecular and Cell Biology*. Himalaya Publishing House Pvt.

Course Code: ZOO 321
Course Title: GENERAL PHYSIOLOGY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)

Unit 1: Physiology of Digestion

(15 class)

Structural organization and functions of gastrointestinal tract and associated glands; Digestion of carbohydrates, proteins and fats; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal control of secretion of enzymes in Gastrointestinal tract.

Unit 2: Physiology of Respiration

(15 class)

Mechanism of respiration, Pulmonary ventilation; Respiratory capacities; Respiratory pigments, Transport of oxygen and carbon dioxide in blood; Oxygen Haemoglobin Dissociation curve, Carbon monoxide poisoning; Regulation of respiration.

Unit 3: Renal Physiology

(10 class)

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance & acid-base balance, kidney failure management.

Unit 4: Circulatory System

(12 class)

Structure of mammalian heart; Cardiac cycle, Pace maker; Components of blood and their functions; Structure and functions of haemoglobin, Haemopoiesis, Blood clotting system and pathways, ABO blood groups: Rh factor, and MN group.

Unit 5: Reproductive System

(8 class)

Histology and functions of testis and ovary, methods of contraception in male and female.

PRACTICALS

(Credits 2)

ZOO(L) 321 LAB: GENERAL PHYSIOLOGY

1. Determination of ABO blood group & Rh factor
2. Enumeration of Red blood cells (RBC) using haemocytometer.
3. Enumeration of White blood cells (WBC) using haemocytometer.
4. Estimation of haemoglobin concentration using haemoglobinometer.
5. Preparation of haemin crystals.
6. Recording of blood pressure using a sphygmomanometer
7. Study of permanent slides of mammalian testis and ovary.

SUGGESTED READINGS

- Guyton, A.C. & Hall, J.E. (2006). *Textbook of Medical Physiology*. XI Edition. Hervecourt Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). *Principles of Anatomy & Physiology*. XI Edition John Wiley & sons, correlations. XII Edition. Lippincott W. & Wilkins.
- Arey, L.B. (1974). *Human Histology*. IV Edition. W.B. Saunders.
- Vander A, Sherman J. and Luciano D. (2014). *Vander's Human Physiology: The Mechanism of Body Function*. XIII Edition, McGraw Hills

Course Code: ZOO 331

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Title: FUNDAMENTALS OF BIOCHEMISTRY

THEORY

(Credits 4)

Unit 1: Carbohydrates

(12 Classes)

Definition, classification and structure of carbohydrates; Glycoconjugates.

Unit 2: Proteins

(14 Classes)

Structure and Classification of amino acids; Amino acid as buffer; Iso-electric pH of amino acids; Physiological importance of essential and nonessential amino acids.

Various levels of organization in proteins with examples; Introduction to simple and conjugated proteins.

Unit 3: Lipids

(12 Classes)

Definition, classification and structure of fatty acids; Classification and structure of lipids.

Unit 4: Nucleic Acids

(10 Classes)

Structure and chemical composition of DNA; Difference between DNA and RNA; Types of DNA; Nucleosides and Nucleotides; C₀t Curves.

Unit 5: Enzymes

(12 Classes)

Definition and classification of enzyme; Mechanism of enzyme action; Factors affecting rate of enzyme-catalyzed reactions; Enzyme kinetics in reference to the concept of Michaelis-Menten's equation, Km and Vmax; Isozymes.

PRACTICAL

(Credits 2)

ZOO(L) 331 LAB: FUNDAMENTALS OF BIOCHEMISTRY

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Identification of amino acids by paper chromatography
3. Effect of pH, temperature and inhibitors on the action of salivary amylase.
4. Demonstration of proteins separation by SDS-PAGE.

SUGGESTED READING

- Cox, M.M and Nelson, D.L. (2008). *Lehninger's Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). *Molecular Biology of the Gene*, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

Course Code: ZOO 341
Course Title: PRINCIPLES OF ECOLOGY

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

THEORY

(Credits 4)

Unit 1: Introduction to Ecology

(12 Classes)

History of ecology; Autecology and synecology; Levels of organization; Laws of limiting factors; Study of physical factors.

Unit 2: Population

(15 Classes)

Population Ecology; Unique and group attributes of population: Density, natality, mortality, fecundity, life tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic growth; Population regulation - density-dependent and independent factors, Population Interactions.

Unit 3: Community

(10 Classes)

Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example; Theories pertaining to climax community.

Unit 4: Ecosystem

(12 Classes)

Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Food web, Energy flow through the ecosystem.

Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with one example of Nitrogen cycle, Human modified ecosystem.

Unit 5: Pollution

(11 Classes)

Types of pollution, Causes, effect and control of Air, Water and Soil Pollution;

Pesticides- mode of transport, Bioconcentration, Bioaccumulation Biomagnification and Biotransformation.

PRACTICALS

(Credits 2)

ZOO(L) 341 LAB: PRINCIPLES OF ECOLOGY

1. Study of life tables and plotting of survivorship curves of different types from the hypo- thetical/real data provided
2. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, temperature, turbidity/ penetration of light, determination of pH, and Dissolved Oxygen and free CO₂

SUGGESTED READINGS

- *Colimvaux, P. A. (1993). Ecology. II Edition.*
- *Wiley, John and Sons, Inc. Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.*
- *Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition.*
- *Brooks/Cole Robert Leo Smith. Ecology and Field Biology. Harper and Row publisher*
- *Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Press*

IV. SKILL ENHANCEMENT COURSES (SEC)

Course Code: ZOO 531
Course Title: PISCICULTURE

| | | | |
|----------------|-------|-------|-------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Unit 1: Scope of Aquaculture (10 classes)

Importance of cultivable fresh water, Types of ponds, water quality, temperature and accessories

Unit 2: Fish culture technique (12 classes)

Monoculture, Polyculture, composite fish culture, Induced fish breeding, Integrated fish farming –Duck and fish

Unit 3: Farm management (8 classes)

Fish nutrition, live fish transport, prevention and control of diseases

SUGGESTED READING:

- *Srinastava, C.B.L. (1999). Fishery Science and Indian Fisheries. Kitab Mahal Publications India*
- *Dunham R.A (2004). Aquaculture and Fisheries Biotechnology – Genetic Approaches. CABI Publications, UK*

Course Code: ZOO 541
Course Title: APICULTURE

| | | | |
|----------------|-------|-------|-------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 20:30 | - | - |

Unit 1: Biology of Bees (10 Classes)

Social Organization of Bee Colony; Various species of bees found in India; Life history of Bees.

Unit 2: Methods and products of bee keeping (12 Classes)

Flora for apiculture, Selection of bees for apiculture; Indigenous method of bee keeping and its drawbacks; Modern method of bee keeping and its advantages. Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc.

Unit 3: Diseases and Enemies (8 Classes)

Bacterial, viral, fungal and protozoan diseases of honey bees and their control measures; Enemies of honey bees and their control measures.

SUGGESTED READINGS

- *Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.*
- *Bisht D.S., Apiculture, ICAR Publication. Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.*

Department of Computer Science & IT

| Semester | Core Courses (14) | Ability Enhancement Compulsory Courses AEC (2) | Skill Enhancement courses SEC (2) | Discipline Specific Elective DSE (4) | Generic Elective GE (4) |
|----------|-----------------------------------|--|-----------------------------------|--------------------------------------|----------------------------------|
| I | Programming Fundamentals using C | English communications | | | Programming Fundamentals using C |
| | Computer System Architecture | | | | |
| II | Programming in JAVA | Environmental Studies | | | Programming in JAVA |
| | Discrete Structures | | | | |
| III | Data Structures using C | | HTML | | Computer Networks |
| | Operating Systems | | | | |
| | Computer Networks | | | | |
| IV | Design and Analysis of Algorithms | | PHP programming | | Database Management Systems |
| | Software Engineering | | | | |
| | Database Management Systems | | | | |
| V | Internet Technologies | | | Information Security | |
| | Theory of Computation | | | Microprocessor | |
| VI | Artificial Intelligence | | | Visual programming | |
| | Computer Graphics | | | Project | |

Semester 1

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Code: BSC 111

Course Title: PROGRAMMING FUNDAMENTALS USING C Lectures = 60 hrs

Objective:

- To understand various aspects of procedural programming and its roles in problem solving by implementing basic data structures

Learning Outcome:

- Problem solving through computer programming;
- Ability to use different memory allocation methods;
- Ability to deal with different input/output methods;
- Ability to use different data structures.

UNIT-I**10 hrs.**

C fundamentals Character set - Identifier and keywords - data types - constants - Variables - declarations - Expressions - Statements - Arithmetic, Unary, Relational and logical , Assignment and Conditional Operators - Library functions.

UNIT-II**14 hrs.**

Data input and output functions - Simple C programs - Flow of control - if, if-else, while, do-while, for loop, Nested control structures - Switch, break and continue, go to statements - Comma operator.

UNIT-III**15 hrs.**

Functions -Definition - prototypes - Passing arguments – Recursion- Storage Classes - Automatic, external, Static, Register Variables.

UNIT-IV**15 hrs.**

Arrays - Defining and Processing - Passing arrays to functions - Multidimensional arrays - Arrays and strings. Structures and unions - User defined data types - Passing structures to functions - Self-referential structures -Unions - Bit wise operations.

UNIT-V**14 hrs.**

Pointers - Declarations - Passing pointers to Functions - Operation on Pointers - Pointer and Arrays - Arrays of Pointers - Structures and Pointers - Files: Creating, Processing , Opening and Closing a data file, Dynamic Memory Allocation

Recommended Books:

- E Balagurasami, Programming in ANSI, TATA McGraw Hill,2004
- B.W. Kernighan and D.M.Ritche, The C Programming Language, 2nd Edition, PHI, 1988.
- H. Schildt, C: The Complete Reference, 4th Edition, TMH Edition, 2000.
- Kanetkar Y., Let us C, BPB Pub., New Delhi

Semester I**Course Code: BCS 112****Course Title: COMPUTER SYSTEM ARCHITECTURE**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Lectures = 60 hrs.**Objective:**

To provide students with a fundamental understanding of the functional components of a computer system, and how they are organized. The emphasis of the module is on the hardware aspects of a system, and how hardware is used during the execution of software. This is a core component of all computer science related degree courses. Practical skills will also be developed in the use and construction of computer components, and their interfacing to microprocessors.

Learning Outcome:

- By the end of the module a student should be able to:
- Understand the operation of electronic logic elements;
- Understand the organization of a computer system in terms of its main components;
- Understand the detailed operation of a simple microprocessor;
- Understand different processor architectures;
- Understand input/output mechanisms;
- Understand the various parts of a system memory hierarchy;

Unit I: Introduction**14 hrs**

Logic gates, Boolean algebra, combinational circuits, circuit simplification, flip-flops and sequential circuits, decoders, multiplexers, registers, counters and memory units.

Unit 2: Basic Computer Organization and Design**13 hrs.**

Organization and Architecture, Structure and Function, Von-Neumann Architecture, Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input - output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer.

Unit-3: Number Systems**12hrs.**

Number systems, complements, fixed and floating point representation, character representation, addition, subtraction, magnitude comparison, and multiplication and division algorithms for integers

Unit 4. Central Processing Unit15 hrs.

Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming, RISC, CISC architectures, pipelining and parallel architecture.

Unit 5. Memory and Input-Output Organization6 hrs.

Cache memory, Associative memory, mapping.

Input / Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.

Recommended Books:

1. M. Mano, *Computer System Architecture*, Pearson Education 1992
2. A. J. Dos Reis, *Assembly Language and Computer Architecture using C++ and JAVA*, Course Technology, 2004
4. W. Stallings, *Computer Organization and Architecture Designing for Performance*, 8 Edition, Prentice Hall of India, 2009
5. M.M. Mano, *Digital Design*, Pearson Education Asia, 2013
6. Carl Hamachi, *Computer Organization*, Fifth edition, McGraw-Hill, 2012.

Semester II

Course Code: BCS 121
 Course Title: PROGRAMMING IN JAVA

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures = 60 hrs.

Objective:

The main objective is to introduce students to some fundamentals of object-oriented programming with Java – objects, method, classes, variables, number types, text strings, control structures and testing. Students will also be introduced to modeling techniques, in order that the object-oriented methodology becomes clear.

Learning outcome

After completing the module, students will be able to:

- Design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and iterative structures, and functions;
- Apply the techniques of structured (functional) decomposition to break a program into smaller pieces;
- Describe and use the mechanics of parameter passing;
- Discuss and use primitive data types and built-in data structures;
- Write clear and comprehensive program documentation;
- Write programs that use data structures, including arrays, strings, linked lists, stacks, queues, sets etc
- Design, implement, test, debug, and document GUI, event-driven programs;

Unit I. Introduction to Java

4 hrs.

Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods).

Unit II. Arrays, Strings and I/O

8 hrs.

- Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects,
- Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System. Out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.

Unit III. Object-Oriented Programming Overview

4 hrs.

Principles of Object-Oriented Programming paradigm, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.

Unit-IV. Inheritance, Interfaces, Packages, Enumerations and Metadata

14 hrs.

hrs.

Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Enumerations and Metadata.

Unit V. Exception Handling, Threading, Applets and Event Handling**15 hrs.**

Exception types, uncaught exceptions, throw, built-in exceptions, creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization. Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, text fields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets.

Recommended Books:

1. Programming in Java – 2nd Edition by C.Muthu, TMH Publication
2. Java How to Program by Deitel&Deitel - 6th Edition- PHI Publication

Semester II

Course Code: BCS I22
Course Title: DISCRETE STRUCTURES

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Lectures = 60 hrs.

Objective:

The course aims to introduce the Fundamental Concepts of Mathematics: Definitions, Proofs, Sets, Growth of Functions, Relations
 Discrete Structures: Modular Arithmetic, Graphs

Learning Outcome:

Students will be able to:

Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers.

Comprehend discrete structures and their relevance within the context of computer science, in the areas of data structures and algorithms, in particular.

Problem Solving: apply discrete structures into other computing problems such as formal specification, verification, databases, and cryptography

Unit I:

14 hrs.

Sets - finite and Infinite sets, uncountable Infinite Sets; functions, relations, Properties of Binary Relations, Closure, Partial Ordering Relations; counting - Pigeonhole Principle, Permutation and Combination; Mathematical Induction, Principle of Inclusion and Exclusion.

Unit II

13 hrs.

Growth of Functions: Asymptotic Notations, Summation formulas and properties, Bounding Summations, approximation by Integrals

Unit III

14 hrs.

Recurrences: Recurrence Relations, generating functions, Linear Recurrence Relations with constant coefficients and their solution, Substitution Method, Recurrence Trees.

Unit IV

14 hrs.

Graph Theory: Basic Terminology, Models and Types, multi graphs and weighted graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Graph Coloring, Trees, Basic Terminology and properties of Trees, Introduction to Spanning Trees

Unit V

13 hrs.

Propositional Logic: Logical Connectives, Well-formed Formulas, Tautologies, Equivalences, Inference Theory.

Recommended Books:

1. C.L. Liu , D.P. Mahopatra, Elements of Discrete mathematics, 2nd Edition , Tata McGraw Hill, 1985,
2. Kenneth Rosen, Discrete Mathematics and Its Applications, Sixth Edition ,McGraw Hill 2006
3. T.H. Cormen, C.E. Leiserson, R. L. Rivets, Introduction to algorithms, 3rd edition Prentice Hall on India, 2009
4. M. O. Albertson and J. P. Hutchinson, Discrete Mathematics with Algorithms, John Wiley Publication, 1988

Semester III

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Code: BCS 131
Course Title: DATA STRUCTURE USING C

Lectures = 60 Hrs.

Objective:

The main objective of this course is to provide an introduction to basic data structures, and algorithms for manipulating them, by using C programming language. This course specifically has the following objectives: The fundamental design, analysis, and implementation of basic data structures and algorithms; the analysis and evaluation of the data structure needs of particular problems; the design, analysis, and implementation of C programs by using basic data structures and algorithms.

Learning Outcome:

Apply advance C programming techniques such as pointers, dynamic memory allocation, structures to developing solutions for particular problems;
 Design and implement abstract data types such as linked list, stack, queue and tree by using C as the programming language using static or dynamic implementations;
 Analyze, evaluate and choose appropriate abstract data types and algorithms to solve particular problems;
 Design and implement C programs that apply abstract data types.

UNIT-I**12 hrs.**

Definition of a Data structure - primitive and composite Data Types, Arrays, Operations on Arrays, Ordered lists.

UNIT-II**14 hrs.**

Stacks – Operations - Applications of Stack - Infix to Postfix Conversion, Recursion, Queue- operations.

UNIT-III**14 hrs.**

Singly Linked List - Operations, Application - Representation of a Polynomial, Polynomial Addition; Doubly Linked List - Operations.

UNIT-IV**14 hrs.**

Trees and Graphs: Binary Trees - Operations – Recursive Tree Traversals Graph - Definition, Types of Graphs, Graph Traversal – DFS and BFS

UNIT-V**14 hrs.**

Searching and sorting: linear and binary search – Sorting Insertion, Bubble, selection sort.

Recommended Books:

1. C++ plus Data structure by N.Dale, publishers narosa publishing, Edition 2000 ;
2. Fundamentals of Data Structure, Galgotia book source;
3. Data Structures Using C – Aaron M Tanenbaum, Yedidyyehlangsam, Moshe J Augenstein.:
- 4.Fundamentals of Data Structure, Galgotia book source;

Semester III

Course Code: BCS 132
Course Title: OPERATING SYSTEMS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures = 60 Hrs.

Objective:

The objective of the course is to provide basic knowledge of computer operating system structures and functioning.

Learning Outcome:

Upon completing the course the student should be able to:

Explain the basic structure and functioning of operating system.

Point the problems related to process management and synchronization, apply learned methods to solve basic problems.

Explain the cause and effect related to deadlocks and is able to analyze them related to common circumstances in operating systems.

Explain the basics of memory management, the use of virtual memory in modern operating systems as well as the structure of the most common file-systems.

Unit-I

14 hrs.

Introduction: Basic OS functions, resource abstraction, types of operating systems— multiprogramming systems, batch systems, time sharing systems; operating systems for personal computers & workstations, process control & real time systems.

Unit-II

12hrs.

Operating System Organization: Processor and user modes, kernels, system calls and system programs.

Unit-III

14hrs.

Process Management I : System view of the process and resources, process abstraction, process hierarchy, threads, threading issues, thread libraries; Process Scheduling, non-pre-emptive and pre-emptive scheduling algorithms; concurrent and processes.

Unit-IV

14 hrs.

Process Management II:

Various aspects of Deadlocks, critical section, semaphores, Remote procedure call, (RPC), methods for inter-process communication (IPC);

Unit-V

14hrs.

Memory, File and I/O Management:

Physical and virtual address space; memory allocation strategies –fixed and variable partitions, paging, segmentation, virtual memory, Directory structure, file operations, files allocation methods, device management.

Recommended Books:

1. A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications 2008.
2. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education 2007.
3. G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education 1997.
4. W. Stallings, Operating Systems, Internals & Design Principles, 5th Edition, Prentice Hall of India.

Semester III

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: BCS 133**Course Title: COMPUTER NETWORKS****Lectures = 60 Hrs.****Objective:**

Introduce the students the various facets of computer networking and their importance.

Learning outcomes:

Upon completing the course the student should be able to:

Understand the way protocols currently in use in the Internet work and the requirements for designing network protocols.

Explain the theory of basic network performance analysis

Identify soundness or potential flaws in proposed protocols

Explain security and ethical issues in computer networking.

UNIT-I**12 hrs.**

Computer networks definition, Topologies, Classification – Network hardware- Network software- Protocol Hierarchies – Layering – Interfaces, services, primitives – OSI reference Model – TCP/IP reference model – physical layer – transmission media - Wireless transmission – switching.

UNIT – II**13 hrs.**

Data link layer: services of DLL – framing – flow control – error control – Error detection codes – Error correction codes – DLL protocol – stop and Wait protocol –sliding window protocol - HDLC – DLL in the internet

UNIT-III**15 hrs.**

Network layer : services of network layer - routing – shortest path routing Algorithm – congestion control – general principle of congestion control Inter network routing – Network layer in the internet – IP protocol –IP address – subnets – internet control protocol

UNIT-IV**14 hrs.**

Transportation layer: services of transportation layer – addressing –Establishing and releasing connection – flow control – buffering –Multiplexing – the internet transportation protocol TCP and UDP – Model – connection management – TCP congestion control – UDP

UNIT-V**14 hrs.**

Application layer – DNS – name space – resource – records – name Servers -Email – architecture and services – user agent – message Format and transfer – USENET implementation – WWW client and Server sides – locating information on the web

Recommended Books:

COMPUTER NETWORKS - ANDREW TANENBAUM - 3rd Edition PHI

Computer Networks – WILLIAM STALLING - PHI

Semester IV

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Code: BCS 143

Course Title: DATABASE MANAGEMENT SYSTEMS

Lectures = 60 hrs.

Objective:

To Provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications. The logical design, physical design and implementation of relational databases are covered.

Learning Outcome:

On completing the course the student will be able to:

Understand and evaluate the role of database management systems in information technology applications within organisations;

Recognise and use contemporary logical design methods and tools for databases;

Derive a physical design for a database from its logical design;

Implement a database solution to an information technology problem;

Understand the SQL data definition and SQL query languages;

Develop sophisticated queries to extract information from large datasets.

1. Introduction

15 hrs.

Database management system, Characteristics of the database approach, Data base system architecture, data models, Role of Database administrators, Role of Database Designers, End Users, Advantages of Using a DBMS and When not to use a DBMS.

2. Entity-Relationship(ER) Modelling

14 hrs.

Entity types, Entity Sets, Attributes and Keys. Relationships, Relationship types, Roles and Structural constraints, Weak Entity Types and Drawing E- R Diagrams, Example Database applications.

3. Relational data model

15hrs.

Relational model concepts, Relational constraints - domain, Basic Relational Algebra operations, SQL queries.

4. Database design

14 hrs.

Mapping ER/EER model to relational database, functional dependencies, Lossless decomposition, Normal forms (upto BCNF)

5. Transaction Processing

10 hrs.

Transaction and System concepts – Desirable properties of Transactions – Schedules and Recoverability. Lock-Based Protocols – Locks, Granting of Locks, and Two phase locking protocol and implementation of locking.

Recommended Books:

1. Singh-Database systems: Concepts, Design & applications, Pearson Education.
2. Abraham Silberschatz, H.F.KorthAndS.Sudarshan-Database System Concepts Mcgraw Hill Publication
3. Gerald Post - DBMS-Designing and Business Applications - McGraw Hill Publications
4. Michael Abbey and Michael.J.Corey-Oracle- A Beginners guide TMH

Semester V

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Code: BCS 151**Course Title: INTERNET TECHNOLOGIES****Lectures = 60 hrs.**

Objective:

This course covers a broad range of techniques in today's Internet and World Wide Web. The main objective is to provide students the concept to:

Understand the major protocols for internetworking in today's Internet

Understand client-server architecture

Perform basic website design

Perform basic client side programming

Perform basic server side programming

Learning Outcome:

On successful completion of this course the student should be able to:

Demonstrate an understanding of the design and construction of internet services.

Write program in X-HTML, Cascading Style Sheets and JavaScript, without the aid of web-development software.

Describe the operations of internet protocols and develop their own internet applications.

Design sites that communicate effectively which are accessible to the widest audience and are attractively designed.

Explain the underlying technological concepts that enable the Internet to work.

Unit-I

14 hrs.

Java: Use of Objects, Array and Array List class

Unit-II

14 hrs.

JavaScript: Data types, operators, functions, control structures, events and event handling.

Unit-III

12 hrs.

JDBC: JDBC Fundamentals, Establishing Connectivity and working with connection interface, working with statements, Creating and Executing SQL Statements, Working with Result Set Objects.

Unit-IV

14 hrs.

JSP: Introduction to Java Server Pages, HTTP and Servlet Basics, The Problem with Servlets, The Anatomy of a JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment, Implicit JSP Objects, Conditional Processing, Displaying Values, Using an expression to Set an Attribute, Declaring Variables and Methods, Error Handling and Debugging, Sharing Data Between JSP Pages, Requests, and Users, Database Access.

Unit-V

14 hrs.

Java Beans: Java Beans Fundamentals, JAR files, Introspection, Developing a simple Bean, Connecting to DB

Recommended Books:

1. Ivan Bayross, Web Enabled Commercial Application Development Using Html, Dhtml, JavaScript, Perl CGI , BPB Publications, 2009.
2. Cay Horstmann, BIG Java, Wiley Publication , 3rd Edition., 2009
3. Herbert Scheldt, Java 7, The Complete Reference, , 8th Edition, 2009.
4. Jim Keogh ,The Complete Reference J2EE, TMH, , 2002.
5. O'Reilly , Java Server Pages, Hans Bergsten, Third Edition, 2003.

Semester V

Course Code: BCS 152
Course Title: THEORY OF COMPUTATION

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Lectures = 60 Hrs.

Objective:

To introduce students the basic concepts in theoretical computer science, and the formal relationships among machines, languages and grammars.

Learning Outcome:

On successful completion of this course the student should be able to:

Demonstrate advanced knowledge of formal computation and its relationship to languages;

Distinguish different computing languages and classify their respective types;

Recognize and comprehend formal reasoning about languages;

Show a competent understanding of the basic concepts of complexity theory.

Unit I

14 hrs.

Languages:

Alphabets, string, language, Basic Operations on language, Concatenation, Keene closure

Unit II

14 hrs.

Finite Automata and Regular Languages:

Regular Expressions, Transition Graphs, Deterministic and non-deterministic finite automata, NFA to DFA Conversion, Regular languages and their relationship with finite automata.

Unit III

14 hrs.

Context free languages:

Context free grammars, parse trees, ambiguities in grammars and languages, Push down automata (Deterministic and Non-deterministic), Pumping Lemma, Properties of context free languages, normal forms.

Unit IV

12 hrs.

Turing Machines:

RAM, Turing Machine as a model of computation, Universal Turing Machine, Language acceptability, decidability, halting problem.

Unit V

14 hrs.

Models of Computations:

Recursively Enumerable (RE) language, recursive language – unsolvability problems, Undecidable problems

About Turing Machine–Post’s Correspondence Problem

The classes P and NP.

Recommended Books:

Daniel A. Cohen, Introduction to computer theory, John Wiley, 1996

Lewes & Papadimitriou, Elements of the theory of computation, PHI 1997.

Hopcroft, Aho, Ullman, Introduction to Automata theory, Language & Computation 3rd Edition, Pearson Education. 2006.

Semester VI

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: BCS 161**Course Title:** ARTIFICIAL INTELLIGENCE**Lectures = 60 Hrs.****Objective:**

Learn the various areas of research of AI and to understand on how a neural network is designed and trained, to know the components of a formal system and to evaluate functions to expedite various search process etc.

Learning Outcome:

On completing this course, students should be able to:

Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.

Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc.

Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).

Design and perform an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.

Unit-I

14 hrs.

Introduction

Introduction to Artificial Intelligence, Background and Applications, Turing Test and Rational Agent approaches to AI, Introduction to Intelligent Agents, their structure, behavior and environment.

Unit-II

14 hrs.

Problem Solving and Searching Techniques:

Problem Characteristics, Production Systems, Control Strategies, Breadth First Search, Depth First Search, Hill climbing and its Variations, Heuristics Search Techniques: Best First Search, A*

algorithm, Constraint Satisfaction Problem, Means-End Analysis, Introduction to Game Playing, Min-Max and Alpha-Beta pruning algorithms.

Unit-III

14hrs.

Knowledge Representation:

Introduction to First Order Predicate Logic, Resolution Principle, Unification, Semantic Nets, Conceptual Dependencies, Frames, and Scripts, Production Rules, Conceptual Graphs.

Programming in Logic (PROLOG)

Unit-IV

12 hrs.

Dealing with Uncertainty and Inconsistencies:

Truth Maintenance System, Default Reasoning, Probabilistic Reasoning, Bayesian Probabilistic Inference, Possible World Representations.

Unit-V

14 hrs.

Understanding Natural Languages:

Parsing Techniques, Context-Free and Transformational Grammars, Recursive and Augmented Transition Nets.

Recommended Books:

DAN.W. Patterson, Introduction to AI and Expert Systems – PHI, 2007.

Russell & Norvig, Artificial Intelligence-A Modern Approach, LPE, Pearson Prentice Hall, 2nd edition, 2005.

3. Rich & Knight, Artificial Intelligence – Tata McGraw Hill, 2nd edition,

1991. W.F. Clocksin and Mellish, Programming in PROLOG, Narosa Publishing House, 3rd edition, 2001.

Semester VI

Course Code: BCS 162
Course Title: COMPUTER GRAPHICS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures = 60 Hrs.

Objective:

To introduce students with fundamental concepts of computer graphics and to give basics of application programming interface (API) design. Discuss the various types of algorithms involved.

Learning Outcome:

At the end of this course, the students will be able to:
 Have a basic understanding of the core concepts of computer graphics.
 Analyze and use algorithms.
 Create interactive computer graphics.

UNIT-I

14 hrs.

Introduction to computer Graphics - Video display devices- Raster scan Systems - Random Scan Systems - Interactive input devices - Hard copy devices - Graphics software - Output primitives - line drawing algorithms - initializing lines - line function - circle Generating algorithms.

UNIT-II

14 hrs.

Attributes of output Primitives - line attributes - Color and Grayscale style -Area filling algorithms - Character attributes inquiry functions - Two dimensional transformation - Basic transformation - Composite transformation - Matrix representation - other transformations.

UNIT-III

12 hrs.

Two - dimensional viewing - window- to view port co-ordinate transformation -clipping algorithms - Interactive input methods - Physical input devices - logical classification of input devices - interactive picture construction methods.

UNIT- IV

14 hrs.

Three - dimensional concepts - Three dimensional display methods - parallel Projection - Perspective Projection - Depth Cueing - Visible line and surface identification - Three dimensional transformation.

UNIT-V

14 hrs.

Three dimensional viewing - Projection - Viewing transformation -implementation of viewing operations - Hidden surface and Hidden line removal - back face removals.

Recommended Books:

1. D. Hearn and M. P. Baker - Computer Graphics (C version) - Pearson Education.
2. W.M. Newman and RF. Sproull - Principles of Interactive Computer Graphics - McGraw Hill International Edition – 1979

**Discipline Specific Elective Course
Semester V**

Course Code: BCS 251
Course Title: Information Security

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures = 60Hrs.

Objective

To provide an insight into the various facets of information security including the key concepts and terminologies. This knowledge will develop a “security mindset” in the students and teach them to critically analyze situations of computer and network.

Learning Outcome

On successful completion of this course the student should be able to:

Identify various terminologies of information security and outline their major components

Introduce the types of threats to information security.

Develop strategies to protect organization's information assets.

Understand how security policies, standards and practices are developed.

Understand firewalls and packet filtering.

Unit-I

14 hrs.

Introduction: Need for Security, Attacks, Attack Types, Computer Criminals, Security Services, Security Mechanisms.

Unit –II

14 hrs.

Cryptography: Substitution ciphers, Transpositions Cipher, avalanche effect, Confusion, diffusion, Symmetric, Asymmetric Encryption. Digital Encryption System (DES), Uses of Encryption, Hash function, key exchange, Digital Signatures, Digital Certificates, Digital Watermarking.

Unit-III

12 hrs.

Threats: Protection in OS: Memory and Address Protection, Access control, File Protection, User Authentication.

Unit-IV

14hrs.

Database & Network Security: Requirements, Reliability, Integrity, Sensitive data, Inference, Multi-level Security, Threats in Networks, Security Controls, firewalls, Intrusion detection systems.

Unit–V

14 hrs.

Administrating Security:

SecurityPlanning,RiskAnalysis,OrganizationalSecurityPolicy,PhysicalSecurity. Ethical issues in Security: Protecting Programs and data. Information and law.

Recommended Books:

1. C. P. Pfleeger, S.L. Pfleeger; Security in Computing, Prentice Hall ofIndia, 2006
2. W. Stallings; Network Security Essentials: Applications and Standards, 4/E, 2010

**Discipline Specific Elective Course
Semester V**

Course Code: BCS 252
Course Title: Microprocessor:

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Lectures = 60Hrs.

Objective:

The objective of this course is to provide extensive knowledge of microprocessor based systems and interfacing techniques and to introduce the basic concepts of microprocessor and assembly language programming.

Learning Outcome:

- On successful completion of this course the student should be able to:
- Analyze, specify, design, write and test assembly language programs of moderate complexity.
- Select an appropriate 'architecture' or program design to apply to a particular situation; e.g. an interrupt-driven I/O handler for a responsive real-time machine. Following on from this, the student will be able to design and build the necessary programs.

Unit I: Introduction and Architecture of 8086

12hrs.

Historical evaluation of microprocessors, microprocessor based computer system, computer data formats, internal microprocessor architecture, programming model, different types of register, flags, segment registers

Unit II: Addressing Modes

12hrs.

Register, immediate, direct, register indirect, based plus index, program memory-addressing modes, stack memory-addressing modes.

Unit III: Data Movement Instructions

14hrs.

MOV instruction- various type, push, pop, LEA, string data transfer, Miscellaneous data transfer instructions- XCHG, XLAT, segment override prefix, IN and OUT

Unit IV: Arithmetic and Logic Instructions

15hrs.

Add, subtract, multiply and Divide instructions, BCD and ASCII arithmetic, Basic logic instructions, shift and rotate, string comparison

Unit V: Program Control Instructions

15 hrs.

Jump – various types (conditional and unconditional), Loop, do-while and Repeat-until loops in MASM 6.x, procedures and parameter passing, CALL and REL instructions

Additional Topics

Introduction to interrupt vectors, interrupt instructions, controlling the carry flag bit, WAIT, HLT, NOP, LOCK, ESC, BOUND, ENTER and LEAVE

Text Book:

1. Intel Microprocessors 4th edition by Burry M Brey – PHI
2. **Reference Book**
3. Microprocessor X86 programming by KR Venugopal and Raj Kumar, BPB publications 1995
4. Schaums Series Assembly language programming
5. Microprocessors and Interfacing by D. V. Hall, Tata McGraw Hill

**Discipline Specific Elective Course
Semester VI**

Course Code: BCS 261
Course Title: VISUAL PROGRAMING

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures = 60 hrs.

Objective:

The course is designed to guide the beginning programmer in developing applications using the Visual Basic.Net (VB.NET) programming languages. Students will be introduced to object-oriented programming concepts along with VB.NET syntax to implement them.

Learning Outcome

At the end of this course, the students will be able to:

Understand and identify the fundamental concepts of event driven and object-oriented programming
Generate reports Design and create applications.

UNIT-I

10 hrs.

Introduction: Introduction to .Net, Two tier and Three tier client server model, .Net Architecture, Features of .Net, Advantages of .Net, .Net Framework, CLR, CTS, CLS, Assemblies, Memory management issues – Garbage Collector and collection process, Exception Handling, Code Access Security.

UNIT – II

14 hrs.

Introduction to Visual Basic.Net IDE: Creating a project, Types of project in .Net, Exploring and coding a project, Solution explorer, toolbox, properties window, Output window, Object Browser. VB.Net Programming Language: Similarities and Differences with Visual Basic, Variables, Comments, Data Types, Working with Data Structures – Arrays, Array Lists, Enumerations, Constants, Structures; Introduction to procedures, calling procedures, argument passing mechanisms, scope of variable. Control Flow Statements – conditional statement Loops, Nesting of Loops, MsgBox and Input Box.

UNIT-III

16 hrs.

GUI Programming: Introduction to Window Applications, Using Form – Common Controls, Properties, Methods and Events. Interacting with controls - Textbox, Label, Button, List box, Combo box, Checkbox, PictureBox, Radio Button, Panel, scroll bar, Timer, List View, Tree View, toolbar, Status Bar. Dialog Controls, Creating and Using MDI applications, Toolbar, Status Bar, Creating custom controls, Creating Menus. Object Oriented Features: Classes and Objects, Access Specifiers: Private, Public and Protected, Building Classes, Reusability, Constructors, Inheritance, and Overloading, Overriding, Creating and Using Namespaces.

UNIT – IV

14 hrs.

Introduction to ADO: ADO vs. ADO.Net, ADO.Net data namespaces, ADO.Net Object Model, Accessing data from Server Explorer, Creating Connection, Command, Data Adapter, Data Reader and Data Set with OLEDB and SQLDB, Data Binding.

UNIT – V

14 hrs.

Crystal Report: Connection to Database, Table, Queries, Building Report, Modifying Report, Formatting Fields, Publishing and exporting reports

Recommended Books:

Visual Basic 2010 programming Black Book, by Kogent Learning Solutions, Wiley India;

Visual Basic 2010 Step By Step, Michael Halvorson, PHI ;

Mastering Microsoft Visual Basic 2010, Evangelos Petroustos, Wiley Publications Beginning Visual Basic 2010 (Wrox); VB.NET Programming Black Book by stevenholzner –dreamtech publications %0 Mastering VB.NET by Evangelospetroustos- BPB publications %0 Introduction to .NET framework-Worx publication.

Course Code: BCS 262

Course Title: Project

Refer BCA Project guidelines

GENERIC ELECTIVE**Semester I**

Course Code: BCS 311
Course Title: COMPUTER FUNDAMENTALS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures = 30 hrs.

Unit I: Introduction to Computer

8hrs.

Definition, characteristics and generations of computer, capabilities and limitations, concept of BIOS, booting files, Major components of a computer -Block diagram, a brief introduction of CPU, Main memory, and I/O units, memory classifications- volatile and nonvolatile, flash memory, RAM, ROM, EPROM, PROM, EEPROM other types of memory.

Unit II: Input and Output devices

8hrs.

Keyboard, pointing devices: muse, trackball, touch panel, and joystick, light pen, scanners, various type of monitors, touch-sensitive screens, Optical Recognition System, pen based systems, digitizers, MICR, OCR, OMR, Bar-code Reader, digital camera

Hard copy devices: impact and non-impact printers- Daisy wheel, Dot matrix, line printer, chain printer, comb printer, non-impact printers- Desk Jet, laser printer.

Unit III: Application Software

14 hrs.

Word Processing

Introduction to Word Processing, features, learning document window, creating, Saving & Closing a document, opening an existing document, editing a document, formatting features (Paragraph formats, aligning text & paragraph, border and shading, header & footer, bullet & numbering), inserting & editing a table, inserting picture, checking & spelling correction, page setup, print preview, printing a document.

Spreadsheet

Introduction to spreadsheet, creating, saving and editing a workbook, inserting, deleting worksheets, opening & Moving around in an existing worksheet, working with formula & cell referencing, functions, working with ranges – creating, editing and selecting ranges, format feature- AutoFormat feature, changing alignment, character styles, date format, border & colors etc.

Presentation Tools

Creating & saving presentations, opening an existing presentation, working in different views, working with slides, adding and formatting text, formatting paragraphs, checking spelling and correcting typing mistakes, adding clip art and other pictures, inserting animation, designing slide shows, running and controlling slide show, printing presentation

Text Book

Computer Fundamentals - B. Ram – New Age International Publishers

C.S. French “Data Processing and Information Technology”, BPB Publications

Computer Fundamentals – P K Sinha, BPB Publications

Computers Today – Suresh K Basandra, Galgotia

Semester II

Course Code: BCS 321
Course Title: PROGRAMMING IN JAVA

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures = 60 hrs.

Objective:

The main objective is to introduce students to some fundamentals of object-oriented programming with Java – objects, method, classes, variables, number types, text strings, control structures and testing. Students will also be introduced to modeling techniques, in order that the object-oriented methodology becomes clear.

Learning outcome

After completing the module, students will be able to:

- Design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and iterative structures, and functions;
- Apply the techniques of structured (functional) decomposition to break a program into smaller pieces;
- Describe and use the mechanics of parameter passing;
- Discuss and use primitive data types and built-in data structures;
- Write clear and comprehensive program documentation;
- Write programs that use data structures, including arrays, strings, linked lists, stacks, queues, sets etc
- Design, implement, test, debug, and document GUI, event-driven programs;

Unit I. Introduction to Java

4 hrs.

Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods).

Unit II. Arrays, Strings and I/O

8 hrs.

- Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects,
- Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System. Out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.

Unit III. Object-Oriented Programming Overview

4 hrs.

Principles of Object-Oriented Programming paradigm, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.

Unit-IV. Inheritance, Interfaces, Packages, Enumerations and Metadata

14 hrs.

Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Enumerations and Metadata.

Unit V. Exception Handling, Threading, Applets and Event Handling**15 hrs.**

Exception types, uncaught exceptions, throw, built-in exceptions, creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization. Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, text fields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets.

Recommended Books:

1. Programming in Java – 2nd Edition by C.Muthu, TMH Publication
2. Java How to Program by Deitel&Deitel - 6th Edition- PHI Publication

Semester III

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: BCS 331**Course Title: COMPUTER NETWORKS****Lectures = 60 Hrs.****Objective:**

Introduce the students the various facets of computer networking and their importance.

Learning outcomes:

- Upon completing the course the student should be able to:
- Understand the way protocols currently in use in the Internet work and the requirements for designing network protocols.
- Explain the theory of basic network performance analysis
- Identify soundness or potential flaws in proposed protocols
- Explain security and ethical issues in computer networking.

UNIT-I**12 hrs.**

Computer networks definition, Topologies, Classification – Network hardware- Network software- Protocol Hierarchies – Layering – Interfaces, services, primitives – OSI reference Model – TCP/IP reference model – physical layer – transmission media - Wireless transmission – switching.

UNIT – II**13 hrs.**

Data link layer: services of DLL – framing – flow control – error control – Error detection codes – Error correction codes – DLL protocol – stop and Wait protocol –sliding window protocol – HDLC – DLL in the internet

UNIT-III**15 hrs.**

Network layer : services of network layer - routing – shortest path routing Algorithm – congestion control – general principle of congestion control Inter network routing – Network layer in the internet – IP protocol –IP address – subnets – internet control protocol

UNIT-IV**14 hrs.**

Transportation layer: services of transportation layer – addressing –Establishing and releasing connection – flow control – buffering –Multiplexing – the internet transportation protocol TCP and UDP – Model – connection management – TCP congestion control – UDP

UNIT-V**14 hrs.**

Application layer – DNS – name space – resource – records – name Servers -Email – architecture and services – user agent – message Format and transfer – USENET implementation – WWW client and Server sides – locating information on the web

Recommended Books:

1. COMPUTER NETWORKS - ANDREW TANENBAUM - 3rd Edition PHI
2. Computer Networks – WILLIAM STALLING - PHI

Semester IV

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Course Code: BCS 341

Course Title: DATABASE MANAGEMENT SYSTEMS

Lectures = 60 hrs.

Objective:

To Provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications. The logical design, physical design and implementation of relational databases are covered.

Learning Outcome:

- On completing the course the student will be able to:
- Understand and evaluate the role of database management systems in information technology applications within organisations;
- Recognise and use contemporary logical design methods and tools for databases;
- Derive a physical design for a database from its logical design;
- Implement a database solution to an information technology problem;
- Understand the SQL data definition and SQL query languages;
- Develop sophisticated queries to extract information from large datasets.

1. Introduction**15 hrs.**

Database management system, Characteristics of the database approach, Data base system architecture, data models, Role of Database administrators, Role of Database Designers, End Users, Advantages of Using a DBMS and When not to use a DBMS.

2. Entity-Relationship(ER) Modelling**14 hrs.**

Entity types, Entity Sets, Attributes and Keys. Relationships, Relationship types, Roles and Structural constraints, Weak Entity Types and Drawing E- R Diagrams, Example Database applications.

3. Relational data model**15hrs.**

Relational model concepts, Relational constraints - domain, Basic Relational Algebra operations, SQL queries.

4. Database design**14 hrs.**

Mapping ER/EER model to relational database, functional dependencies, Lossless decomposition, Normal forms (upto BCNF)

5. Transaction Processing**10 hrs.**

Transaction and System concepts – Desirable properties of Transactions – Schedules and Recoverability. Lock-Based Protocols – Locks, Granting of Locks, and Two phase locking protocol and implementation of locking.

Recommended Books:

1. Singh-Database systems: Concepts, Design & applications, Pearson Education.
2. Abraham Silberschatz, H.F.KorthAndS.Sudarshan-Database System Concepts Mcgraw Hill Publication
3. Gerald Post - DBMS-Designing and Business Applications - McGraw Hill Publications
4. Michael Abbey and Michael.J.Corey-Oracle- A Beginners guide TMH

**Skill Enhancement Course
Semester III**

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 0:30 | 20:0 | - |

Course Code: BCS 531

Course Title: HTML PROGRAMMING:

Lectures = 30 Hrs.

Objective:

Learn the scripting language and the basic concepts of web designing.

Learning Outcome:

- On successful completion of this course the student should be able to:
- Use Scripts to create web pages
- Know the use of basic html tags.
- Hyper linking the web pages to form a basic web site.
- Create a simple web page.

Unit-I

8 hrs.

Introduction to Internet: Internet and WWW, Browsers, Servers, Web Pages, Web Sites, E-mail, IRC (chat), and Search Engines, URLs, Domain Names, Web Hosting and DNS, Web publishing, and W3C, Protocols: TCP/IP, FTP, & HTTP

Unit-II

6 hrs.

Basics: The Head, the Body, Colors, Attributes, Lists, ordered and unordered

Unit-III

6 hrs.

Links: Introduction, Relative Links, Absolute Links, Link Attributes, Using the ID Attribute to Link within a Document.

Unit-IV

6 hrs.

Images: Putting an Image on a Page, Using Images as Links, Putting an Image in the Background.

Unit-V

8 hrs.

Table: Creating a table, table Headers, Captions, Spanning multiple Columns, Styling table
Forms: Basic Input and Attributes, other kinds of inputs, styling forms with CSS.

Book Recommended:

1. Virginia De Bolt ,Integrated HTML and CSSA Smarter, Faster Way to Learn Wiley/ Sybex, 2006
2. Cassidy Williams, Camryn Williams Introduction to HTML and CSS, O'Reilly, 2

Skill Enhancement Course
Semester IV

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 0:30 | 20:0 | - |

Course Code: BCS 541

Course Title: PHP Programming

Lectures = 30 hrs.

Objective:

To introduce students the basic concepts in web programming, perform basic website design, perform basic client side programming as well as perform basic server side programming

Learning Outcome:

- On successful completion of this course the student should be able to:
- Install and configure required software systems and tools.
- Create PHP scripts that:
- Create a web-based system (such as a shopping system) .
- Test and debug PHP scripts.

Unit-I

6 hrs.

Introduction

PHP introduction, inventions and versions, important tools and software requirements (like Web Server, Database and Editor set c.) PHP with other technologies, scope of PHP, Basic Syntax, PHP variables and constants. Types of detain PHP, Expressions, scopes of a variable (local, global), PHP Operators: Arithmetic, Assignment, Relational, Logical operators, Bitwise, ternary and MOD operator.PHP operator Precedence and associatively

Unit-II

6 hrs.

Handling HTML form with PHP: Capturing Form Data GET and POST form methods dealing with multi value fields, redirecting a form after submission.

Unit-III

6 hrs.

PHP conditional events and Loops:: PHP IF Else conditional statements (Nested IF and Else), Switch case, while, For and Do While Loop, Goto, Break, Continue and exit.

Unit-IV

8 hrs.

PHP Functions: Function, Need of Function, declaration and calling of a function, PHP Function with arguments, Default Arguments in Function, Function argument with call by value, call by reference Scope of Function Global and Local.

Unit-V

8 hrs.

String Manipulation and Array Creating and accessing String, Searching & Replacing String ,Formatting, joining and splitting String, String Related Library functions, Use and advantage of regular expression over inbuilt function, Use of preg_match(),preg_replace(), preg_split()functions in regular expression, Anatomy of an Array, Creating index based and Associative array, Accessing array, Looping with Index based array, with associative array using each() and for each(), Some useful Library function.

Recommended Books:

1. Steven Holzner, "PHP: TheCompleteReferencePaperback", McGrawHill Education (India), 2007.
2. TimothyBoronzcyk, Martin E. Psinas, "PHP and MYSQL (Create-Modify-Reuse)", Wiley India PrivateLimited, 2008.
3. Robin Nixon, "LearningPHP, MySQL, JavaScript, CSS&HTML5", 3rdEdition Paperback, O'reilly, 2014.
4. Luke Welling, Laura Thompson, "PHPandMySQLWeb Development", 4th Edition, Addition Paperback, Addison-WesleyProfessional, 2008.

SYLLABUS FOR: Bachelor of Computer Application (CBCS)

| Semester | Core Courses (14) | Ability Enhancement Compulsory Courses AEC (2) | Skill Enhancement courses SEC (2) | Discipline Specific Elective DSE (4) | Generic Elective GE (4) |
|----------|-----------------------------------|--|-----------------------------------|--------------------------------------|--|
| I | Programming Fundamentals using C | English communications | | | Computer Fundamentals/ Consumer Affairs and Customer Care |
| | Computer System Architecture | | | | |
| II | Programming in JAVA | Environmental Studies | | | Mathematical Foundation |
| | Discrete Structures | | | | |
| III | Data Structures using C | | HTML | | Financial Accounting |
| | Operating Systems | | | | |
| | Computer Networks | | | | |
| IV | Design and Analysis of Algorithms | | PHP programming | | Numerical Methods |
| | Software Engineering | | | | |
| | Database Management Systems | | | | |
| V | Internet Technologies | | | Information Security | |
| | Theory of Computation | | | Microprocessor | |
| VI | Artificial Intelligence | | | Visual programming | |
| | Computer Graphics | | | Project | |

I. CORE COURSES (CC)

Course Code: BCA 111

Course Title: PROGRAMMING FUNDAMENTALS USING C

Lectures = 60hrs.

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Objective:

- To understand various aspects of procedural programming and its roles in problem solving by implementing basic data structures

Learning Outcome:

- Problem solving through computer programming;
- Ability to use different memory allocation methods;
- Ability to deal with different input/output methods;
- Ability to use different data structures.

UNIT-I

10 hrs.

C fundamentals Character set - Identifier and keywords - data types - constants - Variables - declarations - Expressions - Statements - Arithmetic, Unary, Relational and logical , Assignment and Conditional Operators - Library functions.

UNIT-II

14 hrs.

Data input and output functions - Simple C programs - Flow of control - if, if-else, while, do-while, for loop, Nested control structures - Switch, break and continue, go to statements - Comma operator.

UNIT-III

15 hrs.

Functions -Definition - prototypes - Passing arguments – Recursion- Storage Classes - Automatic, external, Static, Register Variables.

UNIT-IV

15 hrs.

Arrays - Defining and Processing - Passing arrays to functions - Multidimensional arrays - Arrays and strings. Structures and unions - User defined data types - Passing structures to functions - Self-referential structures -Unions - Bit wise operations.

UNIT-V

14 hrs.

Pointers - Declarations - Passing pointers to Functions - Operation on Pointers - Pointer and Arrays - Arrays of Pointers - Structures and Pointers - Files: Creating, Processing , Opening and Closing a data file, Dynamic Memory Allocation

Recommended Books:

- E Balagurasami, Programming in ANSI, TATA McGraw Hill,2004
- B.W. Kernighan and D.M.Ritchie, The C Programming Language, 2nd Edition, PHI, 1988.
- H. Schildt, C: The Complete Reference, 4th Edition, TMH Edition, 2000.
- Kanetkar Y., Let us C, BPB Pub., New Delhi

Course Code: BCA 112
Course Title: COMPUTER SYSTEM ARCHITECTURE

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Lectures = 60 hrs.

Objective:

To provide students with a fundamental understanding of the functional components of a computer system, and how they are organized. The emphasis of the module is on the hardware aspects of a system, and how hardware is used during the execution of software. This is a core component of all computer science related degree courses. Practical skills will also be developed in the use and construction of computer components, and their interfacing to microprocessors.

Learning Outcome:

- By the end of the module a student should be able to:
- Understand the operation of electronic logic elements;
- Understand the organization of a computer system in terms of its main components;
- Understand the detailed operation of a simple microprocessor;
- Understand different processor architectures;
- Understand input/output mechanisms;
- Understand the various parts of a system memory hierarchy;

Unit I: Introduction

14 hrs.

Logic gates, Boolean algebra, combinational circuits, circuit simplification, flip-flops and sequential circuits, decoders, multiplexers, registers, counters and memory units.

Unit 2: Basic Computer Organization and Design

13 hrs.

Organization and Architecture, Structure and Function, Von-Neumann Architecture, Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input -output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer.

Unit 3 : Number Systems 12hrs.

Number systems, complements, fixed and floating point representation, character representation, addition, subtraction, magnitude comparison, and multiplication and division algorithms for integers

Unit 4. Central Processing Unit

15 hrs.

Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming, RISC, CISC architectures, pipelining and parallel architecture.

Unit 5. Memory and Input-Output Organization

6 hrs.

Cache memory, Associative memory, mapping.

Input / Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.

Recommended Books:

1. M. Mano, Computer System Architecture, Pearson Education 1992
2. A. J. Dos Reis, Assembly Language and Computer Architecture using C++ and JAVA, Course Technology, 2004th
3. W. Stallings, Computer Organization and Architecture Designing for Performance, 8 Edition, Prentice Hall of India, 2009
4. M.M. Mano, Digital Design, Pearson Education Asia, 2013
5. Carl Hamachi, Computer Organization, Fifth edition, McGraw-Hill, 2012.

Course Code: BCA 121
Course Title: PROGRAMMING IN JAVA

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures = 60 hrs.

Objective:

The main objective is to introduce students to some fundamentals of object-oriented programming with Java – objects, method, classes, variables, number types, text strings, control structures and testing. Students will also be introduced to modeling techniques, in order that the object-oriented methodology becomes clear.

Learning outcome

- After completing the module, students will be able to:
- Design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and iterative structures, and functions;
- Apply the techniques of structured (functional) decomposition to break a program into smaller pieces;
- Describe and use the mechanics of parameter passing;
- Discuss and use primitive data types and built-in data structures;
- Write clear and comprehensive program documentation;
- Write programs that use data structures, including arrays, strings, linked lists, stacks, queues, sets etc
- Design, implement, test, debug, and document GUI, event-driven programs;

Unit I. Introduction to Java

4 hrs.

Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods).

Unit II. Arrays, Strings and I/O

8 hrs.

Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System. Out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.

Unit III. Object-Oriented Programming Overview

4 hrs.

Principles of Object-Oriented Programming paradigm, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.

Unit IV. Inheritance, Interfaces, Packages, Enumerations and Metadata 14 hrs.

Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Enumerations and Metadata.

Unit V. Exception Handling, Threading, Applets and Event Handling

15 hrs.

Exception types, uncaught exceptions, throw, built-in exceptions, creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple

Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes. The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, textfields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets.

Recommended Books:

1. Programming in Java – 2nd Edition by C.Muthu, TMH Publication
2. Java How to Program by Deitel&Deitel - 6th Edition- PHI Publication

Course Code: BCA 122
Course Title: DISCRETE STRUCTURES
Lectures = 60 hrs.

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Objective:

The course aims to introduce the Fundamental Concepts of
 Mathematics: Definitions, Proofs, Sets, Growth of Functions, Relations
 Discrete Structures: Modular Arithmetic, Graphs

Learning Outcome:

- Students will be able to:
- Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers.
- Comprehend discrete structures and their relevance within the context of computer science, in the areas of data structures and algorithms, in particular.
- Problem Solving: apply discrete structures into other computing problems such as formal specification, verification, databases, and cryptography

Unit I:**14 hrs.**

Sets - finite and Infinite sets, uncountable Infinite Sets; functions, relations, Properties of Binary Relations, Closure, Partial Ordering Relations; counting - Pigeonhole Principle, Permutation and Combination; Mathematical Induction, Principle of Inclusion and Exclusion.

Unit II**13 hrs.**

Growth of Functions: Asymptotic Notations, Summation formulas and properties, Bounding Summations, approximation by Integrals

Unit III**14 hrs.**

Recurrences: Recurrence Relations, generating functions, Linear Recurrence Relations with constant coefficients and their solution, Substitution Method, Recurrence Trees.

Unit IV**14 hrs.**

Graph Theory: Basic Terminology, Models and Types, multi graphs and weighted graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Graph Coloring, Trees, Basic Terminology and properties of Trees, Introduction to Spanning Trees

Unit V**13 hrs.**

Propositional Logic: Logical Connectives, Well-formed Formulas, Tautologies, Equivalences, Inference Theory.

Recommended Books:

1. C.L. Liu , D.P. Mahopatra, Elements of Discrete mathematics, 2nd Edition , Tata McGraw Hill, 1985,
2. Kenneth Rosen, Discrete Mathematics and Its Applications, Sixth Edition ,McGraw Hill 2006
3. T.H. Cormen, C.E. Leiserson, R. L. Rivets, Introduction to algorithms, 3rd edition Prentice Hall on India, 2009
4. M. O. Albertson and J. P. Hutchinson, Discrete Mathematics with Algorithms, John Wiley Publication, 1988

Course Code: BCA 131
Course Title: DATA STRUCTURE USING C

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures = 60 Hrs.

Objective:

The main objective of this course is to provide an introduction to basic data structures, and algorithms for manipulating them, by using C programming language. This course specifically has the following objectives: The fundamental design, analysis, and implementation of basic data structures and algorithms; the analysis and evaluation of the data structure needs of particular problems; the design, analysis, and implementation of C programs by using basic data structures and algorithms.

Learning Outcome:

- Apply advance C programming techniques such as pointers, dynamic memory allocation, structures to developing solutions for particular problems;
- Design and implement abstract data types such as linked list, stack, queue and tree by using C as the programming language using static or dynamic implementations;
- Analyze, evaluate and choose appropriate abstract data types and algorithms to solve particular problems;
- Design and implement C programs that apply abstract data types.

UNIT-I

12 hrs.

Definition of a Data structure - primitive and composite Data Types, Arrays, Operations on Arrays, Ordered lists.

UNIT-II

14 hrs.

Stacks – Operations - Applications of Stack - Infix to Postfix Conversion, Recursion, Queue-operations.

UNIT-III

14 hrs.

Singly Linked List - Operations, Application - Representation of a Polynomial, Polynomial Addition; Doubly Linked List - Operations.

UNIT-IV

14 hrs.

Trees and Graphs: Binary Trees - Operations – Recursive Tree Traversals Graph - Definition, Types of Graphs, Graph Traversal – DFS and BFS

UNIT-V

14 hrs.

Searching and sorting: linear and binary search – Sorting Insertion, Bubble, selection sort.

Recommended Books:

1. C++ plus Data structure by N.Dale, publishers narosa publishing, Edition 2000 ;
2. Fundamentals of Data Structure, Galgotia book source;
3. Data Structures Using C – Aaron M Tanenbaum, Yedidyehlangsam, Moshe J Augenstein.:
4. Fundamentals of Data Structure, Galgotia book source;

Course Code: BCA 132
Course Title: OPERATING SYSTEMS
Lectures = 60 Hrs.

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Objective:

The objective of the course is to provide basic knowledge of computer operating system structures and functioning.

Learning Outcome:

- Upon completing the course the student should be able to:
- Explain the basic structure and functioning of operating system.
- Point the problems related to process management and synchronization, apply learned methods to solve basic problems.
- Explain the cause and effect related to deadlocks and is able to analyze them related to common circumstances in operating systems.
- Explain the basics of memory management, the use of virtual memory in modern operating systems as well as the structure of the most common file-systems.

Unit-I**14 hrs.**

Introduction: Basic OS functions, resource abstraction, types of operating systems—multiprogramming systems, batch systems, time sharing systems; operating systems for personal computers & workstations, process control & real time systems.

Unit-II**12hrs.**

Operating System Organization: Processor and user modes, kernels, system calls and system programs.

Unit-III**14hrs.**

Process Management I : System view of the process and resources, process abstraction, process hierarchy, threads, threading issues, thread libraries; Process Scheduling, non-pre-emptive and pre-emptive scheduling algorithms; concurrent and processes,

Unit-IV**14 hrs.****Process Management II:**

Various aspects of Deadlocks, critical section, semaphores, Remote procedure call, (RPC), methods for inter-process communication (IPC);

Unit-V**14hrs.****Memory, File and I/O Management:**

Physical and virtual address space; memory allocation strategies –fixed and variable partitions, paging, segmentation, virtual memory, Directory structure, file operations, files allocation methods, device management.

Recommended Books:

1. A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications 2008.
2. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education 2007.
3. G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education 1997.

Course Code: BCA 133
Course Title: COMPUTER NETWORKS
Lectures = 60 Hrs.

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

Introduce the students the various facets of computer networking and their importance.

Learning outcomes:

- Upon completing the course the student should be able to:
- Understand the way protocols currently in use in the Internet work and the requirements for designing network protocols.
- Explain the theory of basic network performance analysis
- Identify soundness or potential flaws in proposed protocols
- Explain security and ethical issues in computer networking.

UNIT-I**12 hrs.**

Computer networks definition, Topologies, Classification – Network hardware- Network software- Protocol Hierarchies – Layering – Interfaces, services, primitives – OSI reference Model – TCP/IP reference model – physical layer – transmission media - Wireless transmission – switching.

UNIT – II**13 hrs.**

Data link layer: services of DLL – framing – flow control – error control – Error detection codes – Error correction codes – DLL protocol – stop and Wait protocol –sliding window protocol - HDLC – DLL in the internet

UNIT-III**15 hrs.**

Network layer : services of network layer - routing – shortest path routing Algorithm – congestion control – general principle of congestion control Inter network routing – Network layer in the internet – IP protocol –IP address – subnets – internet control protocol

UNIT-IV**14 hrs.**

Transportation layer: services of transportation layer – addressing –Establishing and releasing connection – flow control – buffering –Multiplexing – the internet transportation protocol TCP and UDP –Model – connection management – TCP congestion control – UDP

UNIT-V**14 hrs.**

Application layer – DNS – name space – resource – records – name Servers -Email – architecture and services – user agent – message Format and transfer – USENET implementation – WWW client and Server sides – locating information on the web

Recommended Books:

1. COMPUTER NETWORKS - ANDREW TANENBAUM - 3rd Edition PHI
2. Computer Networks – WILLIAM STALLING - PHI

Course Code: BCA 141
Course Title: DESIGN AND ANALYSIS OF ALGORITHMS
Lectures = 60 hrs.

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

Students will learn how to:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

Learning outcome:

- Upon completing the course the student should be capable:
- Implement good principles of algorithm design;
- Analyze algorithms and estimate their worst-case and average-case behavior (in easy cases);
- Familiarize with fundamental data structures and with the manner in which these data structures can best be implemented; become accustomed to the description of algorithms in both functional and procedural styles;

Unit-I INTRODUCTION

13 hrs.

A simple example of design using insertion sort, pseudo code for insertion sort and analysis of time complexity. Performance Analysis – Space complexity and Time complexity (posteriori testing, and a priori approach), Asymptotic Notations (O , Ω , Θ). Polynomial Vs. Exponential Algorithms. Average, Best and Worst case complexity

Unit-II Sorting and Searching Techniques

15 hrs.

Elementary sorting techniques–quick sort, Merge Sort, Advanced Sorting techniques-HeapSort, QuickSort, Sorting in Linear Time-BucketSort, RadixSort and CountSort, Searching Techniques, Medians & Order Statistics.

Unit-III Algorithm Design Techniques

14 hrs.

Introduction to Divide and Conquer Algorithms - Finding the Maximum and Minimum, Quick sort (Derivation of Average case analysis and Worst case analysis), Binary Search (Derivation of Average case analysis).

Unit-IV Balanced Trees

14 hrs.

AVL Tree, Binary Search Tree, Tree Traversal, Heap, Red-Black Trees

Unit-V Graphs and Spanning tree:

12 hrs.

Graph search–Breadth First Search, Depth First Search and their Applications, Greedy Algorithm(minimum cost spanning trees, Kruskal's and Prim's Algorithms, Optimal Merge patterns and Single-Source Shortest Paths)

Recommended Books:

1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction to Algorithms, PHI, 3rd Edition 2009 .
2. Sarabasse & A.V. Gelder Computer Algorithm – Introduction to Design and Analysis, Publisher – Pearson 3rd Edition 1999

Course Code: BCA 142
Course Title: SOFTWARE ENGINEERING
Lectures = 60 Hrs.

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

UNIT-I**14 hrs.**

Introduction to Software Engineering: Definitions - Size Factors - Quality and Productivity Factors - Managerial Issues - Planning a Software Project: Defining the Problem - Goals and Requirements - Solution Strategy - Planning the Development Process: Various Models - Planning an Organizational Structure - Planning Activities

UNIT- II**14 hrs.**

Software cost estimation: Introduction - Software Cost Factors - Software Cost Estimation Techniques - Stating Level estimation - Estimating Software Maintenance Costs Software Requirements Definition - Software Requirements Specification - Specification Techniques - Languages and Processors for Requirements.

UNIT-III**14 hrs.**

Estimation in project planning process, project scheduling, Software Risks, Risk identification, Risk projection and Risk Refinement, RMMM plan, Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for process and projects.

UNIT- IV**14 hrs.**

Design concepts, Architectural Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data Flow into Software Architecture, Modeling Component Level Design

UNIT-V**12 hrs.**

Software Testing Fundamentals, Strategic Approach to Software Testing, Test Strategies for Conventional software, Validation Testing, System Testing, Black Box Testing, White-Box Testing and their types, Basis Path Testing.

Recommended Books:

1. Software Engineering Concepts 1997 Edition Author: RICHARD FAIRLEY Publishers: TATA Mc GRAW-Hill Edition.
2. Software Engineering VI Edition, Author: ROGER S . PRESSMAN Publishers TATA McGraw - HILL International Edition.
3. Software Engineering Programs Documentation operating procedures
4. Author: K.K. AGGARWAL & YOGESH SINGH Publishers: NEW AGE INTERNATIONAL PUBLISHERS

Course Code: BCA 143
Course Title: DATABASE MANAGEMENT SYSTEMS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures = 60 hrs.

Objective:

To Provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications. The logical design, physical design and implementation of relational databases are covered.

Learning Outcome:

- On completing the course the student will be able to:
- Understand and evaluate the role of database management systems in information technology applications within organisations;
- Recognise and use contemporary logical design methods and tools for databases;
- Derive a physical design for a database from its logical design;
- Implement a database solution to an information technology problem;
- Understand the SQL data definition and SQL query languages;
- Develop sophisticated queries to extract information from large datasets.

1. Introduction

15 hrs.

Database management system, Characteristics of the database approach, Data base system architecture, data models, Role of Database administrators, Role of Database Designers, End Users, Advantages of Using a DBMS and When not to use a DBMS.

2. Entity-Relationship(ER) Modelling

14 hrs.

Entity types, Entity Sets, Attributes and Keys. Relationships, Relationship types, Roles and Structural constraints, Weak Entity Types and Drawing E- R Diagrams, Example Database applications.

3. Relational data model

15hrs.

Relational model concepts, Relational constraints - domain, Basic Relational Algebra operations, SQL queries.

4. Database design

14 hrs.

Mapping ER/EER model to relational database, functional dependencies, Lossless decomposition, Normal forms (upto BCNF)

5. Transaction Processing

10 hrs.

Transaction and System concepts – Desirable properties of Transactions – Schedules and Recoverability. Lock-Based Protocols – Locks, Granting of Locks, and Two phase locking protocol and implementation of locking.

Recommended Books:

1. Singh-Database systems: Concepts, Design & applications, Pearson Education.
2. Abraham Silberschatz, H.F.KorthAndS.Sudarshan-Database System Concepts Mcgraw Hill Publication
3. Gerald Post - DBMS-Designing and Business Applications - Mcgraw Hill Publications
4. Michael Abbey and Michael.J.Corey-Oracle- A Beginners guide TMH

Course Code: BCA 151
Course Title: INTERNET TECHNOLOGIES

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Lectures = 60 hrs.

Objective:

This course covers a broad range of techniques in today's Internet and World Wide Web. The main objective is to provide students the concept to:

- Understand the major protocols for internetworking in today's Internet
- Understand client-server architecture
- Perform basic website design
- Perform basic client side programming
- Perform basic server side programming

Learning Outcome:

- On successful completion of this course the student should be able to:
- Demonstrate an understanding of the design and construction of internet services.
- Write program in X-HTML, Cascading Style Sheets and JavaScript, without the aid of web-development software.
- Describe the operations of internet protocols and develop their own internet applications.
- Design sites that communicate effectively which are accessible to the widest audience and are attractively designed.
- Explain the underlying technological concepts that enable the Internet to work.

Unit-I Java: **14 hrs.**

Use of Objects, Array and Array List class

Unit-II JavaScript: **14 hrs.**

Data types, operators, functions, control structures, events and event handling.

Unit-III JDBC: **12 hrs.**

JDBC Fundamentals, Establishing Connectivity and working with connection interface, working with statements, Creating and Executing SQL Statements, Working with Result Set Objects.

Unit-IV JSP: **14 hrs.**

Introduction to Java Server Pages, HTTP and Servlet Basics, The Problem with Servlets, The Anatomy of a JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment, Implicit JSP Objects, Conditional Processing, Displaying Values, Using an expression to Set an Attribute, Declaring Variables and Methods, Error Handling and Debugging, Sharing Data Between JSP Pages, Requests, and Users, Database Access.

Unit-V Java Beans: **14 hrs.**

Java Beans Fundamentals, JAR files, Introspection, Developing a simple Bean, Connecting to DB

Recommended Books:

1. Ivan Bayross, Web Enabled Commercial Application Development Using Html, Dhtml, JavaScript, Perl CGI , BPB Publications, 2009.
2. Cay Horstmann, BIG Java, Wiley Publication , 3rd Edition., 2009
3. Herbert Scheldt, Java 7, The Complete Reference, , 8th Edition, 2009.
4. Jim Keogh ,The Complete Reference J2EE, TMH, , 2002.

Course Code: BCA 152
Course Title: THEORY OF COMPUTATION

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Lectures = 60 Hrs.

Objective:

To introduce students the basic concepts in theoretical computer science, and the formal relationships among machines, languages and grammars.

Learning Outcome:

- On successful completion of this course the student should be able to:
- Demonstrate advanced knowledge of formal computation and its relationship to languages;
- Distinguish different computing languages and classify their respective types;
- Recognize and comprehend formal reasoning about languages;
- Show a competent understanding of the basic concepts of complexity theory.

Unit I Languages: 14 hrs.

Alphabets, string, language, Basic Operations on language, Concatenation, Keene closure

Unit II Finite Automata and Regular Languages: 14 hrs.

Regular Expressions, Transition Graphs, Deterministic and non-deterministic finite automata, NFA to DFA Conversion, Regular languages and their relationship with finite automata.

Unit III Context free languages: 14 hrs.

Context free grammars, parse trees, ambiguities in grammars and languages, Pushdown automata (Deterministic and Non-deterministic), Pumping Lemma, Properties of context free languages, normal forms.

Unit IV Turing Machines: 12 hrs.

RAM, Turing Machine as a model of computation, Universal Turing Machine, Language acceptability, decidability, halting problem.

Unit V Models of Computations: 14 hrs.

Recursively Enumerable (RE) language, recursive language – unsolvability problems, Undecidable problems. About Turing Machine – Post's Correspondence Problem. The classes P and NP.

Recommended Books:

1. Daniel I.A. Cohen, Introduction to computer theory, John Wiley, 1996
2. Lewis' & Papadimitriou, Elements of the theory of computation, PHI 1997.
3. Hopcroft, Aho, Ullman, Introduction to Automata theory, Language & Computation 3rd Edition, Pearson Education. 2006.

Course Code: BCA 161
Course Title: ARTIFICIAL INTELLIGENCE
Lectures = 60 Hrs.

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Objective:

Learn the various areas of research of AI and to understand on how a neural network is designed and trained, to know the components of a formal system and to evaluate functions to expedite various search process etc.

Learning Outcome:

- On completing this course, students should be able to:
- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc.
- Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
- Design and perform an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.

Unit-I Introduction

14 hrs.

Introduction to Artificial Intelligence, Background and Applications, Turing Test and Rational Agent approaches to AI, Introduction to Intelligent Agents, their structure, behavior and environment.

Unit-II Problem Solving and Searching Techniques:

14 hrs.

Problem Characteristics, Production Systems, Control Strategies, Breadth First Search, Depth First Search, Hill climbing and its Variations, Heuristics Search Techniques: Best First Search, A* algorithm, Constraint Satisfaction Problem, Means-End Analysis, Introduction to Game Playing, Min-Max and Alpha-Beta pruning algorithms.

Unit-III Knowledge Representation:

14 hrs

Introduction to First Order Predicate Logic, Resolution Principle, Unification, Semantic-Nets, Conceptual Dependencies, Frames, and Scripts, Production Rules, Conceptual Graphs. Programming in Logic (PROLOG)

Unit-IV Dealing with Uncertainty and Inconsistencies:

12 hrs.

Truth Maintenance System, Default Reasoning, Probabilistic Reasoning, Bayesian Probabilistic Inference, Possible World Representations.

Unit-V Understanding Natural Languages:

14 hrs.

Parsing Techniques, Context-Free and Transformational Grammars, Recursive and Augmented Transition Nets.

Recommended Books:

1. DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 2007.
2. Russell & Norvig, Artificial Intelligence – A Modern Approach, LPE, Pearson Prentice Hall, 2nd edition, 2005.

Course Code: BCA 162
Course Title: COMPUTER GRAPHICS
Lectures = 60 Hrs.

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Objective:

To introduce students with fundamental concepts of computer graphics and to give basics of application programming interface (API) design. Discuss the various types of algorithms involved.

Learning Outcome:

- At the end of this course, the students will be able to:
- Have a basic understanding of the core concepts of computer graphics.
- Analyze and use algorithms.
- Create interactive computer graphics.

UNIT-I

14 hrs.

Introduction to computer Graphics - Video display devices- Raster scan Systems - Random Scan Systems - Interactive input devices - Hard copy devices - Graphics software - Output primitives - line drawing algorithms - initializing lines - line function - circle Generating algorithms.

UNIT-II

14 hrs.

Attributes of output Primitives - line attributes - Color and Grayscale style -Area filling algorithms - Character attributes inquiry functions - Two dimensional transformation - Basic transformation - Composite transformation - Matrix representation - other transformations.

UNIT-III

12 hrs.

Two - dimensional viewing - window- to view port co-ordinate transformation -clipping algorithms - Interactive input methods - Physical input devices - logical classification of input devices - interactive picture construction methods.

UNIT- IV

14 hrs.

Three - dimensional concepts - Three dimensional display methods - parallel Projection - Perspective Projection - Depth Cueing - Visible line and surface identification - Three dimensional transformation.

UNIT-V

14 hrs.

Three dimensional viewing - Projection - Viewing transformation -implementation of viewing operations - Hidden surface and Hidden line removal - backface removals.

Recommended Books:

1. D. Hearn and M. P. Baker - Computer Graphics (C version) - Pearson Education.
2. W.M. Newman and RF. Sproull - Principles of Interactive Computer Graphics - McGraw Hill International Edition – 1979

Course Code: BCA 251
Course Title: Information Security
Lectures = 60Hrs.

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|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Objective

To provide an insight into the various facets of information security including the key concepts and terminologies. This knowledge will develop a “security mindset” in the students and teach them to critically analyze situations of computer and network.

Learning Outcome

- On successful completion of this course the student should be able to:
- Identify various terminologies of information security and outline their major components
- Introduce the types of threats to information security.
- Develop strategies to protect organization's information assets.
- Understand how security policies, standards and practices are developed.
- Understand firewalls and packet filtering.

Unit-I

14 hrs.

Introduction: Need for Security, Attacks, Attack Types, Computer Criminals, Security Services, Security Mechanisms.

Unit –II

14 hrs.

Cryptography: Substitution ciphers, Transpositions Cipher, avalanche effect, Confusion, diffusion, Symmetric, Asymmetric Encryption. Digital Encryption System (DES), Uses of Encryption, Hash function, key exchange, Digital Signatures, Digital Certificates, Digital Watermarking.

Unit-III

12 hrs.

Threats: Protection in OS: Memory and Address Protection, Access control, File Protection, User Authentication.

Unit-IV

14hrs.

Database & Network Security: Requirements, Reliability, Integrity, Sensitive data, Inference, Multilevel Security, Threats in Networks, Security Controls, firewalls, Intrusion detection systems.

Unit –V

14 hrs.

Administrating Security:

Security Planning, Risk Analysis, Organizational Security Policy, Physical Security. Ethical issues in Security: Protecting Programs and data. Information and law.

Recommended Books:

1. C. P. Pfleeger, S.L. Pfleeger; Security in Computing, Prentice Hall of India, 2006
2. W. Stallings; Network Security Essentials: Applications and Standards, 4/E, 2010

Course Code: BCA 252
Course Title: Microprocessor:

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

Lectures = 60Hrs.

Objective:

The objective of this course is to provide extensive knowledge of microprocessor based systems and interfacing techniques and to introduce the basic concepts of microprocessor and assembly language programming.

Learning Outcome:

- On successful completion of this course the student should be able to:
- Analyze, specify, design, write and test assembly language programs of moderate complexity.
- Select an appropriate 'architecture' or program design to apply to a particular situation; e.g. an interrupt-driven I/O handler for a responsive real-time machine. Following on from this, the student will be able to design and build the necessary programs.

Unit I: Introduction and Architecture of 8086

12hrs.

Historical evaluation of microprocessors, microprocessor based computer system, computer data formats, internal microprocessor architecture, programming model, different types of register, flags, segment registers

Unit II: Addressing Modes

12hrs.

Register, immediate, direct, register indirect, based plus index, program memory-addressing modes, stack memory-addressing modes.

Unit III: Data Movement Instructions

14hrs.

MOV instruction- various type, push, pop, LEA, string data transfer, Miscellaneous data transfer instructions- XCHG, XLAT, segment override prefix, IN and OUT

Unit IV: Arithmetic and Logic Instructions

15hrs.

Add, subtract, multiply and Divide instructions, BCD and ASCII arithmetic, Basic logic instructions, shift and rotate, string comparison

Unit V: Program Control Instructions

15 hrs.

Jump – various types (conditional and unconditional), Loop, do-while and Repeat-until loops in MASM 6.x, procedures and parameter passing, CALL and REL instructions. Additional Topics Introduction to interrupt vectors, interrupt instructions, controlling the carry flag bit, WAIT, HLT, NOP, LOCK, ESC, BOUND, ENTER and LEAVE

Text Book

Intel Microprocessors 4th edition by Burry M Brey – PHI

Reference Book

1. Microprocessor X86 programming by KR Venugopal and Raj Kumar, BPB publications 1995
2. Schaums Series Assembly language programming
3. Microprocessors and Interfacing by D. V. Hall, Tata McGraw Hill

Course Code: BCA 261
Course Title: VISUAL PROGRAMING
Lectures = 60hrs.

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Objective:

The course is designed to guide the beginning programmer in developing applications using the Visual Basic.Net (VB.NET) programming languages. Students will be introduced to object-oriented programming concepts along with VB.NET syntax to implement them.

Learning Outcome

- At the end of this course, the students will be able to:
- Understand and identify the fundamental concepts of event driven and object-oriented programming
- Generate reports
- Design and create applications.

UNIT-I

10 hrs.

Introduction: Introduction to .Net, Two tier and Three tier client server model, .Net Architecture, Features of .Net, Advantages of .Net, .Net Framework, CLR, CTS, CLS, Assemblies, Memory management issues – Garbage Collector and collection process, Exception Handling, Code Access Security.

UNIT – II

14 hrs.

Introduction to Visual Basic.Net IDE: Creating a project, Types of project in .Net, Exploring and coding a project, Solution explorer, toolbox, properties window, Output window, Object Browser. VB.Net Programming Language: Similarities and Differences with Visual Basic, Variables, Comments, Data Types, Working with Data Structures – Arrays, Array Lists, Enumerations, Constants, Structures; Introduction to procedures, calling procedures, argument passing mechanisms, scope of variable. Control Flow Statements – conditional statement Loops, Nesting of Loops, MsgBox and Input Box.

UNIT-III

16 hrs.

GUI Programming: Introduction to Window Applications, Using Form – Common Controls, Properties, Methods and Events. Interacting with controls - Textbox, Label, Button, List box, Combo box, Checkbox, Picture Box, Radio Button, Panel, scroll bar, Timer, List View, Tree View, toolbar, Status Bar. Dialog Controls, Creating and Using MDI applications, Toolbar, Status Bar, Creating custom controls, Creating Menus. Object Oriented Features: Classes and Objects, Access Specifiers: Private, Public and Protected, Building Classes, Reusability, Constructors, Inheritance, and Overloading, Overriding, Creating and Using Namespaces.

UNIT – IV

14 hrs.

Introduction to ADO: ADO vs. ADO.Net, ADO.Net data namespaces, ADO.Net Object Model, Accessing data from Server Explorer, Creating Connection, Command, Data Adapter, Data Reader and Data Set with OLEDB and SQLDB, Data Binding.

UNIT – V

14 hrs.

Crystal Report: Connection to Database, Table, Queries, Building Report, Modifying Report, Formatting Fields, Publishing and exporting reports

Recommended Books:

1. Visual Basic 2010 programming Black Book, by Kogent Learning Solutions, Wiley India;
2. Visual Basic 2010 Step By Step, Michael Halvorson, PHI ;
3. Mastering Microsoft Visual Basic 2010, EvangelosPetroustos, Wiley Publications Beginning Visual Basic 2010 (Wrox); VB.NET Programming Black Book by stevenholzner –dreamtech publications % Mastering VB.NET by Evangelospetroustos- BPB publications % Introduc-

Course Code: BCA 262
Course Title: Project

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 1 | P - 5 | T - 0 |
| Marks (CIA:ES) | - | 30:70 | - |

Distribution of marks:

Practical (Project Work) : 70 marks

1. Interface Design 25 marks
2. Validation 15 marks
3. Reports/Presentation 15 marks
4. Viva Voce 15 marks

Internal assessment : 30 marks

Guidelines:

This project will be carried out over a duration of three months, involving about 150 hours. Every student should do a project individually and not in a group, under the guidance of at least one of the faculty members and/ or expert/ professional from an organization outside the college. The selected project can be either of type Model 1 or Model 2. The project Report should be submitted covering the aspects specified under Project Profile below. The project Report should have a certificate from the College stating it to be a bonafide work of the student that has not been submitted for any other examination.

Project Profile:

Model 1:

1. The topic for the project can be any sub-system of a system software or tool or any scientific or a fairly complex algorithmic situation.
2. The aim of this type is to highlight the abilities of algorithmic formulation, program and data flow representation, modular programming, optimized code preparation, systematic documentation and other associated aspects of software engineering.
3. The assessment would be through the Project report and Viva. The former should portray the following:
 - Programming style, structured design, minimum compiling and high cohesion.
 - Good commenting and annotating of the code and flow of representation such that meaningful code with good readability and ease of maintenance, results.
 - Design specifications, depicting the method adopted and giving a simple data dictionary for each data, to cover name, type and validity aspects.
 - Test case samples, enough in number to adequately cover the possible chances of common errors
 - User manual

Model 2:

This model can be of a typical business application. The aim of this type is to highlight the stages involved in a typical business oriented project development though on a miniature scale and simulated environment. The appropriate use of DBMS/RDBMS towards any business application along with adequate level system analysis and structured design and development of specific tools/ products would be underlying activity in preparing this project.

The emphasis should be on selecting a system/ sub-system which shows the DBMS and System Analysis aspects to a greater degree. Any small and simple business system may be selected although

candidates are advised to use their knowledge and creativity to select typical and intelligent applications, rather than run-of-the-mill themes such as simple pay-roll calculation or Issue return portion of an inventory scheme. The evaluation stage would give due weightage for the theme selection, problem analysis, fact finding techniques and initial design which is as close to real life business situations as possible.

The project may be carried out in any of the X base family products which is equivalent to Dbase FoxPro or in COBOL. The Code can be generated out of fourth GL. Interface like Screen Builder and Report Generator or can be totally hand-coded or a combination of both. The documentation need not contain the code generated by these applications but only that written by the candidate.

The assessment would be through the Project Report and Viva. The former should portray the following.

Requirements leading to the project, those which were the result of System Analysis

The design aspects of DBMS oriented documentation which describes the structure and organization of the database well annotated source code, supplemented documentation, which can serve as a Data Analysis and Flow description.

A simple Data Dictionary of the elements, which form the structure, the number of tables/ files which make up the DBMS should not be less than three.

- Details about I/O screens and facilities for onscreen query, printed oriented Reports and built in house keeping routines which help disk management and file integrity are to be included to a limited extent.
- Details of Acceptance Tests which should be in adequate number and should include error messages.
- User manual

Viva-Voce:

The viva-voce will be conducted by an external examiner appointed by the University and an internal examiner from the College. Other members of the faculty and students may be present. It will be of a duration of about 15 to 20 minutes. The logic, analysis and design aspects relevant to the project mentioned under assessment would be the main subject matter for the viva. However the general proficiency of the candidate in the selected software platform should also be tested.

Documentation

1. System Overview will have the following sections:
Application area: e.g. Production/ Inventory/Finance/Marketing/Human Resource Management/Library/Training/Service sector/System Level Programming etc.
2. System/Subsystem: e.g. Invoicing and Accounts Receivables, Purchase and Accounts Payables, Budget and Accounts Variance analysis, Production and Sales Monitoring, Material Requirement Planning, Hotel management/Hospital Management/Specific Software utility.
3. End user (s): Finance Controller, Marketing Manager, Production Manager, Personnel Department, School or College or Hospital administrative staff, etc.
4. Analysis and description of the system and the specific gains from computerization.
5. Description of the various modules.
6. Performance criteria for the proposed system: e.g., volume of transactions (Data handling), control aspects, timeliness, archival.
7. Need for review: Deficiencies and future enhancements.

Data Dictionary:

This should give catalogue of the data elements used in the system/subsystem developed. The following are the details required: Write NA where Not

- Applicable.
- Data name
- Aliases, if any:
- Length (size)
- Type (numeric, alpha, binary, etc.)
- Validity criterion (minima, maxima, etc.)
- Default value, if any.
- Whether related to other data items
- Where used in the program reference to data structure/file/procedure/modules.

User Manual:

- It may include chapters like the one suggested below:
- Installation
- Hardware requirements
- System requirements
- Installation procedure, including security aspects like passwords, protection, backups, controls, etc.
- Menu choices and their actions-screen formats
- Error messages
- Output
- A sample test case

FORMAT FOR PREPARATION OF PROJECT REPORT FOR BCA**ARRANGEMENT OF CONTENTS:**

The sequence in which the project report material should be arranged and bound should be as follows:

Cover Page & Title Page
Bonafide Certificate
Abstract
Table of Contents
List of Tables
List of Figures
List of Symbols, Abbreviations and Nomenclature
Chapters
Appendices
References

The table and figures shall be introduced in the appropriate places.

PAGE DIMENSION AND BINDING SPECIFICATIONS:

The dimension of the project report should be in A4 size. The project report should be bound using flexible cover of the thick white art paper. The cover should be **printed in black letters** and the text for printing should be identical.

PREPARATION FORMAT:

3.1 Cover Page & Title Page – A specimen copy of the Cover page & Title page of the project report are given in **Appendix 1**.

3.2 Bonafide Certificate – The Bonafide Certificate shall be in double line spacing using Font Style Times New Roman and Font Size 14, as per the format in **Appendix 2**.

The certificate shall carry the supervisor's signature and shall be followed by the supervisor's name, academic designation (not any other responsibilities of administrative nature), department and full address of the institution where the supervisor has guided the student. The term '**SUPERVISOR**' must be typed in capital letters between the supervisor's name and academic designation.

3.3 Abstract – Abstract should be one page synopsis of the project report typed double line spacing, Font Style Times New Roman and Font Size 14.

3.4 Table of Contents – The table of contents should list all material following it as well as any material which precedes it. The title page and Bonafide Certificate will not find a place among the items listed in the Table of Contents but the page numbers of which are in lower case Roman letters. One and a half spacing should be adopted for typing the matter under this head. A specimen copy of the Table of Contents of the project report is given in **Appendix 3**.

3.5 List of Tables – The list should use exactly the same captions as they appear above the tables in the text. One and a half spacing should be adopted for typing the matter under this head.

3.6 List of Figures – The list should use exactly the same captions as they appear below the figures in the text. One and a half spacing should be adopted for typing the matter under this head.

3.7 List of Symbols, Abbreviations and Nomenclature – One and a half spacing should be adopted or typing the matter under this head. Standard symbols, abbreviations etc. should be used.

3.8 Chapters – The chapters may be broadly divided into 3 parts (i) Introductory chapter, (ii) Chapters developing the main theme of the project work (iii) and Conclusion.

The main text will be divided into several chapters and each chapter may be further divided into several divisions and sub-divisions.

Each chapter should be given an appropriate title.

Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they are cited.

Footnotes should be used sparingly. They should be typed single space and placed directly underneath in the very same page, which refers to the material they annotate.

3.9 Appendices – Appendices are provided to give supplementary information, which is included in the main text may serve as a distraction and cloud the central theme.

- Appendices should be numbered using Arabic numerals, e.g. Appendix 1, Appendix 2, etc.
- Appendices, Tables and References appearing in appendices should be numbered and referred to at appropriate places just as in the case of chapters.
- Appendices shall carry the title of the work reported and the same title shall be made in the contents page also.

3.10 List of References –The listing of references should be typed 4 spaces below the heading “REFERENCES” in alphabetical order in single spacing left – justified. The reference material should be listed in the alphabetical order of the first author. The name of the author/ authors should be immediately followed by the year and other details.

A typical illustrative list given below relates to the citation example quoted above.

REFERENCES

1. Aripnammal, S. and Natarajan, S. (1994) ‘Transport Phenomena of Sm Sel – X Asx’, Pramana – Journal of Physics Vol.42, No.1, pp.421-425.
2. Barnard, R.W. and Kellogg, C. (1980) ‘Applications of Convolution Operators to Problems in Univalent Function Theory’, Michigan Mach, J., Vol.27, pp.81–94.
3. Shin, K.G. and Mckay, N.D. (1984) ‘Open Loop Minimum Time Control of Mechanical Manipulations and its Applications’, Proc.Amer.Contr.Conf., San Diego, CA, pp. 1231-1236.

Table and figures - By the word Table, is meant tabulated numerical data in the body of the project report as well as in the appendices. All other non-verbal materials used in the body of the project work and appendices such as charts, graphs, maps, photographs and diagrams may be designated as figures.

4. TYPING INSTRUCTIONS:

The impression on the typed copies should be black in colour.

One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style ‘Calibri’ and Font size 14.

APPENDIX 1

(A typical Specimen of Cover Page & Title Page)

TITLE OF PROJECT REPORT

<1.5 line spacing>

A PROJECT REPORT

Submitted by

<Italic>

NAME OF THE CANDIDATE(S)

in partial fulfillment for the award of the degree

of

<1.5 line spacing><Italic>

BACHELOR OF COMPUTER APPLICATION

IN

BRANCH OF STUDY

PATKAI CHRISTIAN COLLEGE (Autonomous)

NAAC Accreditation: A

Chumukedima-Seithekema, Nagaland

<1.5 line spacing>

(Affiliated to the Nagaland University)

MONTH & YEAR

APPENDIX 2

(A typical specimen of Bonafide Certificate)

PATKAI CHRISTIAN COLLEGE (Autonomous)

BONAFIDE CERTIFICATE

Certified that this project report “.....**TITLE OF THE PROJECT**.....”
is the bonafide work of “.....**NAME OF THE CANDIDATE(S)**.....”
who carried out the project work under my supervision.

<<Signature of the Head of the Department>>
SIGNATURE

<<Signature of the Supervisor>>
SIGNATURE

<<Name>>
HEAD OF THE DEPARTMENT

<<Name>>
SUPERVISOR

<<Academic Designation>>

<<Department>>

<<Department>>

<<Full address of the Dept & College >>

<<Full address of the Dept & College >>

APPENDIX 3

(A typical specimen of table of contents)

TABLE OF CONTENTS

| CHAPTER NO. | TITLE | PAGE NO. |
|--------------------|--------------------------|-----------------|
| | ABSTRACT | iii |
| | LIST OF TABLE | xvi |
| | LIST OF FIGURES | xviii |
| | LIST OF SYMBOLS | xxvii |
| | | |
| 1. | INTRODUCTION | 1 |
| | 1.1 GENERAL | 1 |
| | 1.2 | 2 |
| | 1.2.1 General | 5 |
| | 1.2.2 | 12 |
| | 1.2.2.1 General | 19 |
| | 1.2.2.2 | 25 |
| | 1.2.2.3 | 29 |
| | 1.2.3 | 30 |
| | 1.3 | 45 |
| | 1.4 | 58 |
| 2. | LITERATURE REVIEW | 69 |
| | 2.1 GENERAL | 75 |
| | | 99 |
| | 2.2 | 100 |

Course Code: BCA 311
Course Title: COMPUTER FUNDAMENTALS

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 15:35 | - |

Unit I: Introduction to Computer

6 hrs

Definition, characteristics and generations of computer, capabilities and limitations, concept of BIOS, booting files, Major components of a computer -Block diagram, a brief introduction of CPU, Main memory, and I/O units, memory classifications- volatile and nonvolatile, flash memory, RAM, ROM, EPROM, PROM, EEPROM other types of memory.

Unit II: Input and Output devices

6 hrs

Keyboard, pointing devices: muse, trackball, touch panel, and joystick, light pen, scanners, various type of monitors, touch-sensitive screens, Optical Recognition System, pen based systems, digitizers, MICR, OCR, OMR, Bar-code Reader, digital camera

Hard copy devices: impact and non-impact printers- Daisy wheel, Dot matrix, line printer, chain printer, comb printer, non-impact printers- DeskJet, laser printer, thermal transfer printer, barcode printers, electro static printer and plotters

Unit III Number Systems

8 hrs

Decimal system, binary system, binary addition and subtraction, binary multiplication and division, converting decimal numbers to binary, negative numbers, use of complements to represent negative numbers, complements in other number system, binary complements, binary coded-decimal number representation, octal and hexadecimal number systems, ASCII, EBDIC

Unit IV: Software

5 hrs

Software and its different types- system software, application software, operating system, firmware, compiler, interpreter and Assembler, Low Level Language and High Level language

Unit V: Application Software

9 hrs

Word Processing

Introduction to Word Processing, features, learning document window, creating, Saving & Closing a document, opening an existing document, editing a document, formatting features (Paragraph formats, aligning text & paragraph, border and shading, header & footer, bullet & numbering), inserting & editing a table, inserting picture, checking & spelling correction, page setup, print preview, printing a document, Mail Merge, Document Template & Wizards.

Spreadsheet

Introduction to spreadsheet, creating, saving and editing a workbook, inserting, deleting worksheets, opening & Moving around in an existing worksheet, working with formula & cell referencing, functions, working with ranges – creating, editing and selecting ranges, format feature- AutoFormat feature, changing alignment, character styles, date format, border & colors etc.

Presentation Tools

Creating & saving presentations, opening an existing presentation, working in different views, working with slides, adding and formatting text, formatting paragraphs, checking spelling and correcting typing mistakes, adding clip art and other pictures, inserting animation, designing slide shows, running and controlling slide show, printing presentation

Text Book

Computer Fundamentals - B. Ram – New Age International Publishers

C.S. French “Data Processing and Information Technology”, BPB Publications

Computer Fundamentals – P K Sinha, BPB Publications

Computers Today – Suresh K Basandra, Galgotia

Lab : Windows and MS Office**WINDOWS OPERATING SYSTEM**

- 1.Windows elements-desktop, icons, taskbars etc...
- 2.Configuring the system- Checking the system configuration ,wallpaper, screen, refresh rate, Date/time , Pointer, Disk Partitions , Start menu(configure), Add/remove programs
- 3.Utilities – disk cleanup, disk defragmenter etc...
- 4.Working with files and folders-Create, rename, edit, move, delete etc...
- 5.Typing skill(fingering)
- 6.Print screen

MS-OFFICE**MS-WORD**

1. Text Manipulations
2. Usage of Numbering, Bullets, Tools and Headers
3. Usage of Spell Check and Find and Replace
4. Text Formatting
5. Picture Insertion and Alignment
6. Creation of Documents Using Templates`
7. Creation of Templates
8. Mail Merge Concept
9. Copying Text and Picture From Excel
10. Creation of Tables, Formatting Tables
11. Splitting the Screen
12. Opening Multiple Document, Inserting Symbols in Documents

MS-EXCEL

1. Creation of Worksheet and Entering Information
2. Aligning, Editing Data in Cell
3. Excel Function (Date , Time, Statistical, Mathematical, Financial Functions)
4. Changing of Column Width and Row Height (Column and Range of Column)
5. Moving, copying, Inserting and Deleting Rows and Columns
6. Formatting Numbers and Other Numeric Formats
7. Drawing Borders Around Cells
8. Creation of Charts Raising Moving
9. Changing Chart Type
10. Controlling the Appearance of a Chart

MS -POWER POINT

Working With Slides

1. Creating, saving, closing presentation
2. Adding Headers and footers
3. Changing slide layout
4. Working fonts and bullets
5. Inserting Clip art
 - 5.1 working with clipart
 - 5.2 Applying Transition and animation effects
6. Run and Slide Show

Course Code: BCA 321
 Course Title: MATHEMATICAL FOUNDATIONS

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 5 | P - 0 | T - 1 |
| Marks (CIA:ES) | 30:70 | - | - |

UNIT -I: PROBABILITY

10 hrs.

Introduction, Sample, Space and events, Conditional Probability, Independent events, Addition and Multiplication theorem on probability, Random variables, Mathematical Expectation, Theorems on Expectations, Variance of a variable in terms of Expectations.

UNIT- II : CO-ORDINATE GEOMETRY:

10 hrs.

Two dimensional geometry: Straight Lines - Pair Straight Lines – Circles
 3Dimensional geometry: Planes, straight lines, spheres.

UNIT III: TRIGONOMETRY

9 hrs.

Trigonometric or Circular Functions, Conditional Identities involving the angles of a triangle, Trigonometric equations, Graphs of trigonometric functions)

UNIT -III: DIFFERENTIAL CALCULUS:

11 hrs.

Derivative of a function, important derivatives using first principle, derivative of sum, differences, derivatives of composite functions, Mean value theorem, partial differentiation, successive differentiation, Total Differentiation.

UNIT IV : INTEGRAL CALCULUS

11hrs.

Definition, fundamental theorem of calculus, Methods of integration by parts, by substitution, integration of algebraic and trigonometric functions, Definite integrals

UNIT-V DIFFERENTIAL EQUATION

9 hrs.

RECOMMENDED BOOKS

Fundamentals of Statistics- S.C.Gupta

Shanti Narayan, “Differential calculus” & “Integral Calculus”.

Thomas & Finney: “Calculus with Analytical Geometry”

P.Duraipandian & Others, Analytical Geometry 2 Dimension - Emerald publication 1992 Reprint.

Course Code: BCA 531
Course Title: HTML PROGRAMMING:

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 1 | P - 1 | T - 0 |
| Marks (CIA:ES) | 0:30 | 20:0 | - |

Objective:

Learn the scripting language and the basic concepts of web designing.

Learning Outcome:

- On successful completion of this course the student should be able to:
- Use Scripts to create web pages
- Know the use of basic html tags.
- Hyper linking the web pages to form a basic web site.
- Create a simple web page.

Unit-I**8 hrs.**

Introduction to Internet: Internet and WWW, Browsers, Servers, Web Pages, Web Sites, E-mail, IRC (chat), and Search Engines, URLs, Domain Names, Web Hosting and DNS, Web publishing, and W3C, Protocols: TCP/IP, FTP, & HTTP

Unit-II**6 hrs.**

Basics: TheHead, theBody, Colors, Attributes, Lists, ordered and unordered

Unit-III**6 hrs.**

Links: Introduction, RelativeLinks, AbsoluteLinks, Link Attributes, UsingtheIDAttributetoLink withinaDocument.

Unit-IV**6 hrs.**

Images:PuttinganImageonaPage, Using Images asLinks, PuttinganImagein theBackground.

Unit-V**8 hrs.**

Table:Creating a table, tableHeaders, Captions, Spanning multipleColumns,Styling table
 Forms:BasicInput and Attributes, other kinds ofinputs,stylingforms with CSS.

BookRecommended:

1. VirginiaDeBolt ,Integrated HTMLand CSSA Smarter,FasterWaytoLearn Wiley/ Sybex, 2006
2. CassidyWilliams, CamrynWilliamsIntroductionto HTMLand CSS, O'Reilly, 2

Course Code: BCA 541
Course Title: PHP Programming

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 1 | P - 1 | T - 0 |
| Marks (CIA:ES) | 0:30 | 20:0 | - |

Objective:

To introduce students the basic concepts in web programming, perform basic website design, perform basic client side programming as well as perform basic server side programming

Learning Outcome:

- On successful completion of this course the student should be able to:
- Install and configure required software systems and tools.
- Create PHP scripts that:
- Create a web-based system (such as a shopping system) .
- Test and debug PHP scripts.

Unit-I

6 hrs.

Introduction

PHP introduction, inventions and versions, important tools and software requirements (like Web Server, Database and Editor set c.) PHP with other technologies, scope of PHP, Basic Syntax, PHP variables and constants.Types of detain PHP, Expressions, scopes of a variable (local, global),PHP Operators: Arithmetic, Assignment, Relational, Logical operators, Bitwise, ternary and MOD operator.PHP operator Precedence and associatively

Unit-II

6 hrs.

Handling HTML form with PHP: Capturing Form Data GET and POST form methods dealing with multi value fields, redirecting a form after submission.

Unit-III

6 hrs.

PHP conditional events andLoops:: PHP IF Else conditional statements (Nested IF and Else), Switch case, while, For and Do While Loop, Goto, Break, Continue and exit.

Unit-IV

8 hrs.

PHP Functions: Function, Need of Function, declaration and calling of a function, PHP Function with arguments, Default Arguments in Function, Function argument with call by value, call by reference Scope of Function Global and Local.

Unit-V

8 hrs.

String Manipulation and Array Creating and accessing String, Searching &Replacing String ,Formatting, joining and splitting String, String Related Library functions,Useand advantage of regular expression over inbuilt function,Use of preg_match(),preg_replace(),preg_split()functions in regular expression, Anatomy of an Array, Creating index based and Associative array, Accessing array,Loopingwith Index based array, with associative array using each() and for each(), Some useful Library function.

Recommended Books:

1. Steven Holzner, "PHP: TheCompleteReferencePaperback", McGrawHill Education (India), 2007.
2. TimothyBoronzcyk, Martin E. Psinas, "PHP and MYSQL (Create-Modify-Reuse)", Wiley India PrivateLimited, 2008.
3. Robin Nixon, "LearningPHP, MySQL, JavaScript, CSS&HTML5", 3rdEdition Paperback, O'reilly, 2014.
4. Luke Welling, Laura Thompson, "PHPand MySQLWebDevelopment", 4th Edition, Addition Paperback, Addison-WesleyProfessionnal, 2008.

ENVIRONMENTAL STUDIES

Ability Enhancement Course (AEC)

Course Code: EVS 411/EVS 421
Course Title: Environment Studies

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ES) | 0:50 | - | - |

Unit 1: Introduction to environmental studies (2 lectures)

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

Unit 2: Ecosystems (6 lectures)

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:

- a) Forest ecosystem
- b) Grassland ecosystem
- c) Desert ecosystem
- d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Natural Resources: Renewable and Non-renewable Resources (8 lectures)

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4: Biodiversity and Conservation (8 lectures)

- Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 5: Environmental Pollution (8 lectures)

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.
- Pollution case studies.

Unit 6: Environmental Policies & Practices (6 lectures)

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 7: Human Communities and the Environment (6 lectures)

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit 8: Field work (Equal to 5 lectures)

- Visit to an area to document environmental assets: river/ forest/ flora/ fauna, etc.
- Visit to a local polluted site---Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems---pond, river, Delhi Ridge, etc.

Suggested Reading

1. Carson, R. 2002. *Silent Spring* Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. *This Fractured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M. K. 2013. Threats from India's Himalaya dams. *Science*, 339: 36-37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams* (pp. 29-64). Zed Books.
8. McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
9. Odum, E. P., Odum, H. T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I. L., Gerba, C. P. & Brusseau, M. L. 2011. *Environmental and Pollution Science*. Academic Press.
11. Rao, M. N. & Datta, A. K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P. H., Hassenzahl, D. M. & Berg, L. R. 2012. *Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India. Tripathi 1992*.
14. Sengupta, R. 2003. *Ecology and economics: An approach to sustainable development*. OUP.
15. Singh, J. S., Singh, S. P. and Gupta, S. R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
16. Sodhi, N. S., Gibson, L. & Raven, P. H. (eds). 2013. *Conservation Biology. Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger. A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WBSaunders.
19. Wilson, E. O. 2006. *The Creation: An appeal to save life on earth*. New York: Norton.
20. World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press.

MASS COMMUNICATION (UG)

| SEMESTER I | | CREDITS | MARKS | L | P | T |
|--------------------------|---|---------|-------|---|---|---|
| GENERAL COMPONENT | | | | | | |
| EVS 411 | Environmental Science | 2 | 50 | 2 | - | - |
| MAC 112 | Media Laws and Ethics | 4 | 100 | 4 | - | - |
| GENERIC 311 | Pol Sc/Eco/His/Bcom/Eng | 6 | 100 | 6 | - | - |
| SKILL COMPONENT | | | | | | |
| MAC 111 | Introduction to Mass Communication and Journalism | 6 | 150 | 4 | 2 | - |
| MAC 113 | Photography and Visual Communication | 6 | 150 | 4 | 2 | - |
| MAC 114 | Communication Skills | 6 | 150 | 4 | 2 | - |
| SEMESTER II | | CREDITS | MARKS | L | P | T |
| GENERAL COMPONENT | | | | | | |
| MAC 121 | Communication for Development | 4 | 100 | 4 | - | - |
| ENG 421 | English Communication | 2 | 50 | 2 | - | - |
| GENERIC | Pol Sc/Eco/His/Bcom/Eng | 6 | 100 | 6 | - | - |
| SKILL COMPONENT | | | | | | |
| MAC 122 | Print Media Production | 6 | 150 | 4 | 2 | - |
| MAC 123 | Video Production | 6 | 150 | 4 | 2 | - |
| MAC 124 | Public Relations | 6 | 150 | 4 | 2 | - |
| SEMESTER III | | CREDITS | MARKS | L | P | T |
| GENERAL COMPONENT | | | | | | |
| MAC 131 | Media, Culture and Society | 4 | 100 | 4 | - | - |
| MAC 132 | Mobile and Digital Journalism | 4 | 100 | 2 | - | - |
| GENERIC | Pol Sc/Eco/His/Bcom/Eng | 6 | 100 | 6 | - | - |
| SKILL COMPONENT | | | | | | |
| MAC 133 | Communication for Rural Engagement | 6 | 150 | 2 | 4 | - |
| MAC 134 | Editing for TV | 6 | 150 | 2 | 4 | - |
| MAC 135 | Public Service Announcements | 6 | 150 | - | 6 | - |
| SEMESTER IV | | CREDITS | MARKS | L | P | T |
| GENERAL COMPONENT | | | | | | |
| MAC 141 | Media in North East India | 4 | 100 | 4 | - | - |
| MAC 142 | Communication and Disaster Management | 4 | 100 | 4 | - | - |

| | | | | | | |
|--------------------------|---|----------------|--------------|----------|----------|----------|
| GENERIC | Pol Sc/Eco/His/Bcom/Eng | 6 | 100 | 6 | - | - |
| SKILL COMPONENT | | | | | | |
| MAC 143 | Integrated marketing communication | 6 | 150 | 4 | 2 | - |
| MAC 144 | News anchoring/current affairs analysis | 6 | 150 | 2 | 4 | - |
| MAC 145 | Publication design and layout | 6 | 150 | - | 6 | - |
| SEMESTER V | | CREDITS | MARKS | L | P | T |
| GENERAL COMPONENT | | | | | | |
| MAC 151 | Radio production and Journalism | 4 | 100 | 4 | - | - |
| MAC 152 | The Grammar of Documentary | 4 | 100 | 4 | - | - |
| MAC 153 | Television Journalism | 4 | 100 | 4 | - | - |
| SKILL COMPONENT | | | | | | |
| MAC 154 | Radio programming | 6 | 150 | - | 6 | - |
| MAC 155 | 30 minutes documentary | 6 | 150 | - | 6 | - |
| MAC 156 | Industry interface (Media study tour) | 6 | 150 | - | 6 | - |
| SEMESTER VI | | CREDITS | MARKS | L | P | T |
| GENERAL COMPONENT | | | | | | |
| MAC 161 | Film studies | 4 | 100 | 4 | - | - |
| MAC 162 | New Media | 4 | 100 | 4 | - | - |
| MAC 163 | Communication research | 4 | 100 | 4 | - | - |
| SKILL COMPONENT | | | | | | |
| MAC 164 | Internship | 6 | 150 | - | 6 | - |
| MAC 165 | Short fiction film/music video | 6 | 150 | - | 6 | - |
| MAC 166 | Photography exhibition | 6 | 150 | - | 6 | - |

SEMESTER I**GENERAL COMPONENT**

Course Code: MAC 112
Course Title: Media Laws and Ethics

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I- Approaches to Understanding Ethics

Defining ethics
 Ethical theories of relevance to media
 Principles of media ethics

Unit II- The Constitution of India

Introduction to the constitution of India
 Preamble
 Article 19
 Limitations to article 19
 Fundamental rights and duties

Unit III- Media Ethics and Social Responsibilities

Ethical issues in news media coverage (Business pressures, sources and reporters, bias and objectivity, sting operation, trial by media, sensationalism)
 Ethical issues in entertainment- violence, offensive material, piracy
 Ethical issues in advertising
 Media and PIL
 Media and RTI

Unit IV- Press Laws and Media laws in India

Defamation
 Contempt of court act 1971
 Official secrets act 1923 and Copyright act 1957
 Cable TV network regulations
 Prasar Bharati Act, Right to information act
 Cyber laws in India, information technology act 2000
 Censor board
 Press commissions and their recommendations
 Copyright act
 The sedition law
 Invasion of privacy

Unit V- Media Conduct and Issues

Professional Conduct of Journalist
 Paid news Vs Chequebook Journalism
 Yellow Journalism
 Fake news
 Plagiarism
 Obscenity
 Censorship
 National Interest and Foreign Relations
 Other Areas of Conflict

Suggested readings

- Press Council of India (2010), Norms of Journalistic Conduct.
 Streckfuss, R. (1990). "Objectivity in Journalism: A Search and a Reassessment." Journalism Quarterly 67: 973-983.
 Laws of the Press in India by Durga Das Basu Prentice Hall, Delhi.
 Indian Press Laws by Radhakrishnamurthi India Law House).
 Media & Press Laws by Gaurav Oberoi.
 Press Laws & Media Ethics by Anil K Dixit Reference Press.
 Media & Ethics by S. K Aggarwal Shipra Publication
 Basu, D.D. (2004). Introduction to the Constitution of India. Prentice-Hall of India.
 Manna, B, Mass Media And Related Laws in India, Academic Publishers.
 Singh, P.P. et. al., (1998). Media, Ethics and Laws, Anmol.
 Prabhakar, M. et. al., (1999). A Compendium of Codes of Conduct for Media Professional, University Book House.
 Fackler, Mark et. al., (1995). Media Ethics -Cases and Moral Reasoning, Longman

SKILL COMPONENT

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 0:50 | - |

Course Code: MAC 111**Course Title: Introduction to Communication and Journalism****Unit I- Understanding Communication and Journalism**

- Fundamentals of communication
- Forms of communication
- Definitions and processes
- Functions and elements of communications
- Concepts, nature, scope and principles of journalism
- Backpack journalism
- Citizen journalism

Unit II- Mass Media- History and Development

- Print media (history, trends, strength, limitations)
- Electronic media (history, trends, strength, limitations)
- New media (history, trends, strength, limitations)
- Convergence media (history, trends, strength, limitations)

Unit III- Models of Communication

- Aristotle's Model of Communication
- Lasswell's Model of Communication (1948)
- Shannon and Weaver's Mathematical Model of Communication (1948)
- Osgood and Schramm's Circular Model (1954)
- Berlo's S-M-C-R Model (1960)

Unit IV- Communication Theories

- Normative theories
- Media Effects theory
- Uses and gratifications
- Agenda setting
- Spiral of silence
- Limited effects theory
- Cultivation theory

Unit V- Determinants and Shifting Paradigms

Intercultural communication
 Science and agriculture journalism
 Digital communication
 Health communication
 Environmental communication

***As part of the course the students are to write letter to the editor on relevant topics and take up group activities such as organizing a departmental seminar.**

Suggested readings

Writing for Journalists by Hicks
 Ian Hargreaves (2014), Journalism – A very short introduction, Oxford University Press.
 Introduction to Mass Communication: Media Literacy and Culture by Baran, McGraw-Hill
 Media and Mediation: Communication Processes, Vol 1 by Bernard Bel, Sage India
 Professional Journalism by Kamath, M. V.
 Journalism: Principles & Practice by Harcup, T.
 News writing by Hough, G. A.
 Allan, S. (2005). Journalism: critical issues. Maidenhead, England: Open University Press.
 Donsbach, Wolfgang. (2008). The international encyclopedia of communication. Malden, MA: Blackwell Publishing.
 Sterling, C. H. (2009). Encyclopedia of journalism. Thousand Oaks, Calif: SAGE Reference.
 Wilson, J. (1996). Understanding journalism: A guide to issues. London: Routledge.
 McQuail, D. (2010). McQuail's Mass Communication Theory. New Delhi: Sage Publications.
 Stevenson, N. (1997). Understanding media culture: Social theory and mass communication.
 Singhal, A. & Rogers, E M. (2001). India's Communication Revolution: From Bullock Carts to Cyber Marts. New Delhi: Sage Publications.
 McQuail, D. (Ed.) (2007). Mass Communication. Volm. I, II, III & IV. New Delhi: Sage Publications.

Course Code: MAC 113
Course Title: Photography and Visual Communication

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 0:50 | - |

Unit I- Theory of basic photography

History of photography
 Visual grammar
 Elements in photography

Unit II- Understanding Visual Communication

Visual communication and elements
 Visual creativity
 Story telling in four frames
 Shot sizes

Unit III- The Camera

Structure and functions of camera (Camera Settings, Menus, Exposure, Shooting Modes, Balancing)
 Camera: Point & Shoot, SLRs, DSLRs, Mirrorless, Digital
 Exposure and photography
 Experimenting Lenses
 The Exposure Triangle (Shutter speed, Aperture, ISO)
 Lights and lighting setup
 White Factor
 Depth of Field as an Image Making Tool

Unit IV- The Shot

Shot sizes

Composition

Photography composition rules (Rule of Third, Golden Hour, Balancing Elements, Leading Lines, Symmetry and Patterns, Viewpoint, Depth, Framing, Cropping)

Photographic genres

Unit V: Learning and Understanding Various Photography Styles

Based on the features below, the students will have to organize a photography exhibition in semester VI.

Practicum:

Landscape photography

Wildlife

Flora and fauna

Portrait

Street

News

Silhouette

Writing caption

Photoshop and use of colors

Applying effects

Suggested readings

Butler, Yvonne V. The Advanced Digital Photographer's Handbook, Focal Press.

Berger, J. Ways of seeing, Harmondsworth, Penguin, 1972.

Langford, Michael. Fox, Anna., Smith, Richard Sawdon. Langford's Basic Photography: The guide for serious photographers, July 23, 2010, Revised 9th edition.

Edwards, Steve. Photography: A very short introduction, Oxford.

Vilamil, John & Molina, Louis. Multimedia: An introduction. Prentice- Hall, New Delhi, 2001.

Smith Kenneth L, et.al., (2011) Handbook of Visual Communication: Theory, Methods, and Media, Routledge.

Messaris, Paul, (1996). Visual Persuasion – Role of Images in Advertising, Sage.

Hodge, Gavin, et. Al., (1990).An Introduction to Photography, Sandstone Publishing.

Wileman, Ralph E. (1993). Visual Communicating, Educational Technology Publication.

Bergstrom, Bo. (2009). Essentials of Visual Communication. Thames and Hudson.

Drew, Helen. (2005). The Fundamentals of Photography, AVA Publishing.

McCartney, Susan. (2001). Mastering the Basics of Photography, Allworth Press

Course Code: MAC 141
Course Title: Communication Skills

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | - | 0:150 | - |

Presentations- As part of this module, students are required to give presentations on relevant issues of development and submit both hard and soft copy. The students are to organize the hard copy with proper introductions and contents. The presentations will be marked individually while the marks for overall presentation and class participation will be for the group.

Group discussions- As part of this module, students are required to speak in a group and generate a group discussion on relevant issues and policies of the state and central government.

SEMESTER II
GENERAL COMPONENT

| | | | |
|----------------|-------|-------|-------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ES) | 30:70 | - | - |

Course Code: MAC 121
Course Title: Communication for Development

Unit 1 - Development: Concept and Approaches

Development: Meaning and Scope
Developed and Developing Country
Problem and Issues in Development

Unit II - Development Communication: Theory and Practices

Early Development Paradigm and Their Impact
The Dominant Paradigm- Critiques
Models of Development:
Daniel Lerner's Modernisation Model of Development, Everett Rogers-Diffusion of Innovation,
Wilbur Schramm-Magic Multiplier
Role of Development Communicator

Unit III - Media and Development

TV And Rural Out Reach
Relation between Media and Development
Communication and Social Change
Information and Communication Technologies

Unit IV - Development Issues and Discourse

Environment, Health
Sustainable Development
Social Empowerment
Education
Governance
Role of NGOs in Development

Unit V- Applied Communications for Development

Communication Strategy and Message Design
Media Campaign
Development Journalism
Development Support Communication
Participatory Rural Appraisal
Designing Message for campaign

Suggested readings

Srinivas Melkote, &Steeves. (2001). Communication for Development in the Third World, New Delhi: Sage
Servaes, J., Jacobson, T. & White, S.A. (Eds.), Participatory communication for social change. Thousand Oaks: Sage
Wilkins, KG. (Ed.) (2000). Redeveloping communication for social change: Theory practice and power. UK: Rowman and Littlefield Publishers.
McPhail, T. L.(2009).Development communication: Reframing the role of media. UK: Wiley Blackwell

Course Code: MAC 122
Course Title: Print Media Production

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 0:50 | - |

Unit I - Understanding News

What is News?
 Elements of News: Characteristics and Changing Nature
 Organisation of News Story
 News Story Formats
 Balance Reporting and Pre-Publication Verification
 Use of Reference Material and Attributions

Unit II - Functions of News Reporting

Functions and Responsibilities of a Reporter
 The Inverted Pyramid
 Starting To Write Lead
 Functions; Political, Economic, Entertainment, Social and Marketing
 Investigative Reporting
 Interpretative Reporting
 Development Reporting
 Civic Journalism
 Interview and Its Types

Unit III - News Gathering

Sources of News
 Types of Sources
 Ethics and Sources
 Cultivation of Sources

Unit IV- Print Media Organisation

Managerial Functions
 Editorial team
 The Newsroom
 Newspaper
 Magazines

Unit V- Reporting and Editing News

Beat Reporting
 Mastering Your Beat
 Managing News Context
 Principles of Editing Layout
 Reporting Speeches, Writing Stories on Events
 Analysis of News Stories

Suggested readings

Batty Craig and Cain Sandra (2010), Media Writing: A Practical Introduction, Palgrave Macmillan.
 Stovel G (2006) Writing for Mass Media, 6th edition, Allyn and Bacon.
 Melvin Mencher (2006), News Reporting and Writing, 10th edition, McGraw-Hill.
 Strunk, William & White, E.B. (1999). The Elements of Style. Longman.
 Clark, Roy Peter. (2006). Writing Tools: 50 Essential Strategies for Every Writer. Little, Brown.
 Raman, Usha (2009), Writing for the Media, OUP
 Capon, Rene J.AP, Guide to News Writing, Thomson/Peterson's, 2005.

Curtis Macdougall. Macmillian, Interpretative Reporting'.(7th Edn)., NY. 1977.
 George A. Hough, News Writing, Kaniska Publishers,
 Gupta VS, Handbook of reporting & Coomunication Skills, Concept Publishing Company, New Delhi 2003.
 Kamath, M.V. , Professional Journalism, Vikas Publishing house, 2009
 Keeble, Richard, Newspapers Handbook' (3rd ed.). Routledge, London.2001.
 MacDougall, C.D., Interpretative Reporting
 Mencher, Melvin, News Reporting and Writing'.(9th ed).. McGraw Hill, NY. 2003.
 Metzler, Creative interviewing'. Prentice Hall, 1979.
 Fedler, Fred. Harcourt, Bruce Jovanovich. Reporting for the Print media'. (2nd ed) . Inc.,NY. 1979.
 Susan Pape & Sue Featherstone, Newspaper Journalism, Sage Publications

Course Code: MAC 123
Course Title: Video Production

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 0:50 | - |

Unit I - Visual Thinking

Art Vs Craft
 Films and Genre
 TV as a Medium of Communication

Unit II - Principles of TV Production

Audio-Visual Communication
 Language and Grammar TV
 Formats of TV Programmes- Fictional Vs Non-Fictional
 Scripting For Video Production [Story Boards, Treatment, Screenplay, Audio-Visual Script, Production Book]

Unit III - Production Essential

Production Team and Their Roles
 Production Planning- Pre-Production
 Production
 Post Production
 Programme Production

Unit IV- Electronic Field Production

Video Standards
 Video Formats
 Audio Formats

Unit V- Practicum

As part of this module, students are required to form a team; produce and direct one episode of Pat-kai Buzz- A YouTube channel
 Individually review at least four films screened in the department

Suggested readings

Burrows, Thomas D., et.al. (2000) Video Production: Disciplines and Techniques. McGraw-Hill
 Vasuki Belavadi, Video Production, Oxford University Press, 2008
 Laura M. Schwartz, Making Music Videos: Everything you Need to Know from the Best in the Business, Billboard Books, 2007
 Timothy Dwelle, Music Video 101, e-book by Dash entertainment Productions, 2006

Course Code: MAC 124
Course Title: Public Relations

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 0:50 | - |

Unit I- Introduction to Public Relations

Theories and practices of public relations
 Principles and practices of management
 Corporate public relations and communications
 Media and public relations

Unit II- PR Process and Practices

Image building
 Analyzing the public
 Branding and positioning
 Media and public relations
 Public and government affairs

Unit III- Media Planning

Media planning and application
 Defining media objectives
 Information needs for making a media plan
 Demographic measurement

Unit IV- Tool and Technique of PR

Fact finding
 Planning
 Research evaluation
 Building relations
 Persuasion and PR
 e-PR

Unit V - PR's evolving roles

Business
 Government departments
 Corporate sectors
 Social organizations
 Government relations
 Advocacy

Suggested Readings

Barbanarnold: Media Planning(USANTCBusinessBook,1997)
 Barton et al: Essentials of media planning (USA NTC Business Book, 1993)
 Bara joel & dixit veena: Mass Media in India 1998-99 (New Delhi, Publication Division 1999)
 Staiger janet & hake sabine: Convergence Media History (UK: Rutledge Publishing, 2009)
 Warner charles: Media Selling, Television, Print, Internet Radio (AJohnWiley &Sons, Ltd., Publica-
 tions, US, 2009)
 Al Ries and Laura Ries: The Fall of Advertising and the Rise of PR (NY, Harper Collins, 2002)
 Bland Micheal: Effective Media Relations: How to Get Results
 Lihen Oyvind [et.al](#): Public Relations and Social Theory: Key Figures and Concepts (UK: Routledge,
 2009)
 Jaishri Jethwaney: Public relations management, 2010

- Jefkins, Frank: Public Relations is your business (ND, Excel Books, 1995)
- Jethwaney J & Sarkar n n: Public Relations Management (ND, Sterling, 2009)
- Johnston, Jane (ed): Public Relations: Theory and practice (Australia: Allen & Unwin, 2010)
- Kruckeberg T Newsom: This is PR: The Realities of Public Relations (US: Wadsworth Cengage Learnings, 2010)
- L'etang Jacquie: Public Relations, Concepts, Practice and Critique (Sage Publications India, 2008)
- Moss Danny & Barbara Desanto: Public Relations A Managerial Perspective (Sage Publications, London, 2011) ND: Crest Publishing House, 2003)
- Oliver, Sandra: Public relations strategy (New Delhi: Kogan Page, 2008)
- Parsons, Patricia J: Ethics in public relations: A guide to best practice (London: Kogan Page, 2005)
- Theaker Alison: The Public Relations Handbook (4 Edition) (Routledge, UK, 2012)

SEMESTER III GENERAL COMPONENTS

Course Code: MAC 131
Course Title: Media Culture and Society

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I – Media and Society

Media and modernization
Media and socialization
Mediated culture and its impact
Media and issues of representation

Unit II – Intercultural Communication

Definition and communication process
Barrier of intercultural communication
Media as a vehicle for intercultural communication
Rhetoric of Narratives and Image

Unit III - Understanding Media and Culture

Introduction to Culture
Audience as Textual Determinants
Media as Consciousness Industry
Questions of Identity and Culture

Unit IV - Media and Popular Culture

Meaning of Popular Culture
Acquisition and Transformation of Popular Culture
Popular Culture Vs Elite/High Culture
Celebrity Fan Culture and Brand Name

Unit V - Approaches To Understanding Development of Indigenous Communities in India

Contemporary Issues of the Indigenous Tribes
Tribal Rights; Land, Forest and Water
Ethnic Identity and Social Movements

Suggested readings

Samovar, L. A & Porter, R. E. (2000). *Inter-cultural Communication-A Reader*, Wadsworth.
Ravindran, R.K. (1999). *Media and Society*, Commonwealth.
Price, Stuart. (1998). *Communication Studies*, Longman.
Curran, James. (2000). *Mass Media and Society*, Arnold.
Caldwell'(eds) *Production Studies: Cultural Studies of Media Industries*. NewYork: Roulledge.
Livingstone, (2006). 'The Changing Nature of' Audiences:From the Mass Audiene to the Interactive.
Potter, James W (1998). *Media Literacy*. Sage Publications.
Grossberg, Lawrence. et al (1998). *Media-Making: Mass Media in a Popular Culture*. Sage Publications.
Bel, B. et al. (2005) *Media and Mediation*, New Delhi: Sage Publications.
Hodkinson, Paul. (2010) *Media Culture and Society: An Introduction*. Sage Publication,
Osgerby, Bill. "Youth Media," Taylor and Francis, 2004.
Saraf, Babli Moitra. 'In Search of the Miracle Women: Returning the Gaze'. *Translation and Interpreting Studies* (IIS), Vol. Nos. 1& 2. Spring Fall 2008.

Course Code: MAC 132
Course Title: Mobile and Digital Journalism

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I- Introduction

What is Mobile Journalism?
 The Mobile Journalist
 Social Media Journalism
 Background of Mobile and social media journalism

Unit II- The Process of Mobile Journalism

Working with the smart phone
 Merging with social media
 Planning, News gathering, Shooting, Scripting
 Share, Publish and Broadcast
 Breaking the information monopoly

Unit III- Social media, MoJo and Ethics

Fake news vs Social media news
 Citizen Journalism
 Social Activism
 Personal Vs Professional

Unit IV- Microblogging and Social Media

Define, scope and prospects
 Data driven journalism
 Digitizing your life
 Emerging Forms of News Engagement: 360-degree Video, Wearables, etc.
 Social media basics
 Social news gathering, collaboration and curation

Unit V- Practicum

The students are to create a blog and during the semester publish at least four posts
 The students will produce four stories. At least two must be focused on their beat. For each story, the students will use a mobile device and apps for the majority of newsgathering and production. The students will also be expected to use social media tools to engage website so that they know how many times and the type of content to share on social media while they are in the field reporting. Before going in the field, we will hold in -class editorial meetings. The students must explain why the story matters, who are impacted, potential interviewees, and how they will use social media and mobile apps in the newsgathering and production of the story, among other items.

Suggested Readings

Adornato, A. (2018). Mobile and social media journalism: A practical guide. Thousand Oaks, CA: Sage. 216 pp., \$65, \$42.75, ISBN: 9781506357140.
 Briggs, Mark. (2016). Journalism Next: A Practical Guide to Digital Reporting and Publishing (3rd ed.). (ISBN: 978-1-4833-5685-3)

SKILL COMPONENT

Course Code: MAC 133
Course Title: Communication for Rural Engagement

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 2 | P - 4 | T - 0 |
| Marks (CIA:ES) | 30:70 | 0:50 | - |

Unit I - Understanding Rural Community Engagement

Community Media
 Inclusion and Participative Communication
 Effective Rural Communication for Development

Unit II – Experiments in Rural Engagement

Status of rural development in SAARC countries
 UN, World Bank and IMF sponsored rural development experiments
 Rural experiments before independence
 Rural development policies in India

Unit III- Understanding the Rural Social Structure

Rural social issues in the country
 Empowering the rural masses
 Social change and rural societies
 Difference between Rural and Urban societies

Unit IV- Documenting Media Message

Village Development Planning
 Conceptualizing ‘Community Facilitating and Civil Society’
 Natural Resource Management
 Identifying Community Challenges

Unit V - Practicum

Field Visit to a Village
 Study and Development of Village Development Plan
 Design Awareness Campaign
 Designing Social Media Campaign
 Social Media Research
 Story of a village

(Field Study is designed to provide students with the opportunity to examine social problems and evaluate the merit of ideas presented in the classroom. It enables them to practice methods of natural-istic field research, data collection, theory testing, program evaluation and social intervention.)

Suggested Readings

- Kenneth Pigg, Stephen P Gasteyer and Kenneth Martin, (2015) Community Effects of Leadership Development Education: Citizen Empowerment for Civic Engagement. West Virginia Press
- Geldart, P. (2016). Experiential Learning: Changing Behaviour to Improve Performance. Eagle’s Flight, Canada
- G.P. Mishra & B.K. Bajpai, Community Participation in Natural Resource Management, Rawat publication, Jaipur, 2001.
- Kartar Singh, Managing Common Pool Resources: Principles and Case Studies, Oxford, New Delhi, 1994.
- Misra, S.K. and V.K. Puri (71st Revised Edition, 2015) —Indian Economy — Its Development Experience, Himalaya Publishing House, Mumbai.
- T.S. Saraswathi and Baljit Kaur: Human Development and Family Studies in India: an Agenda for Research and Policy, Sage Publications, 1993
- Mahendra Dev, Inclusive Growth in India: Agriculture, Poverty, and Human development, Oxford, New Delhi, 2008.
- Drèze, J and A Sen. India: Economic Development and Social Opportunity, Oxford: Oxford University Press.

Course Code: MAC 134
Course Title: Editing For TV

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 2 | P - 4 | T - 0 |
| Marks (CIA:ES) | 30:70 | 0:50 | - |

Unit I - Lighting Equipments and Techniques

Fundamental Lighting Concepts
 Types of Lights
 Studio Lighting Procedures
 Lighting Objectives

Unit II - Pictorial Elements

Concept of Pictorial Design
 Sets and Graphics
 Scene Elements
 Use of Graphic Design

Unit III – Principles of continuity record

Techniques of shot taking
 Rough cut editing
 Fine cut editing
 Joining of shots
 Purpose of continuity shots

Unit IV – Editing

Introduction to Video Editing
 Broadcast Stages of Video Editing
 Timeline Video Editing
 Non-Linear Editing

Unit V- Practicum

Editing Visuals and Syncing Audios
 To take shots in continuity
 Shot to shot transition

Suggested readings

Anderson, Gary H. "Video Editing and Post Production," Focal Press, London, 1993.
 Gupta, R.G. Audio and Video Systems, Tata Mc Graw- Hill, New Delhi, 2003

Course Code: MAC 135
Course Title: Public Service Announcements

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 6 | L - 0 | P - 6 | T - 0 |
| Marks (CIA:ES) | - | 0:150 | - |

Students as part of the module are to make a short Public Awareness Video on social issues in a team.

SEMESTER IV GENERAL COMPONENT

Course Code: MAC 141
Course Title: Media in Northeast India

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I - Introduction to Northeast India

Brief History of North East India
People, Culture and Customs
Physiographic Features: Natural Resources, Landscape, Forest, International Borders
Northeast in India's Struggle for Freedom

Unit II - Media Scene in Northeast

Growth and Development of Press In Northeast
Colonial Legacy and Role of Christian Missionaries
Print and Electronic Media in the Region
Basic Features and Ownership Pattern
Media in Nagaland: An overview
Current Trend in The Region

Unit III - Challenges for Media in Northeast

Reporting in Conflict Zones
Conflict-sensitive Reporting
Activism & Peace Journalism
Human Rights and Violation
Socio-Political Movements
Immigration/Inner Line Permit
From Look East Policy to Act East Policy

Unit IV- Scope of Media in Northeast

Understanding Emerging Issues in North East
Socio-Political Scene in North East
Issues of Concern in National Media
Professional and academic scope

Unit V- Prospect of Media in Northeast

Media in bridging cultural gap
Advent of vernacular press
Media and cultural diversity in NE
Media activism
Peace Journalism

Suggested Readings

A. K. Gurney: History of the Sibsagar Field; Assam Mission, Nawgaon Jubilee Publication, 1887
Barns Margerita: The Indian Press; London, 1940
Barpujari H.K: The American Missionaries and North-East India (1836-1900 AD); Spectrum Publications, Guawahti/Delhi, 1986
Baruah S. P: Press in Assam—Origin and Development; Lawyer's Book Stall, Guwahati, 1999
Baruah Sanjib, Beyond Counter-insurgency: Breaking the Impasse in Northeast India, Oxford University Press
Borua P.C: Asamar Batori Kakat—Eti Ruprekha (1846-1946/47); Lawyer's Book Stall, Guwahati, 1993
Das, Samir Kumar, Governing India's Northeast
Downs, F.S.: The Mighty Works of God- A Brief History of The Council of Baptist Churches in North-East India: The Mission Period 1836-1950; Christian Literature Centre, Guwahati, 1971

Course Code: MAC 142
Course Title: Communication and Disaster Management

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I – Introduction

Disaster and types of disaster
 Disaster determinants
 Disaster preparedness
 Importance of information in disasters
 Response: Rescue, Relief and Rehabilitation

Unit II – Role of Communication in Disaster Management

Understanding disaster management cycle
 Organizing and effective dissemination of information
 Strategic communication for risk reduction
 IEC in disaster preparedness and response
 Communication, participation and activation of emergency preparedness plan
 Role of media in disaster mitigation

Unit III- Technology and Disaster Communication

Emergency Response- HAM Radio and Community Radio, Internet, Email, Mobile, Social Media, Blogging
 Information Communication Technology
 Distress Communication and Deploying Bio-Surveillance Etc
 Geo Informatics Technology (GIT)

Unit IV – Case Studies of Natural Disaster and Role of Media

The Nepal Earthquake of April 2015
 The Kashmir Floods, Oct 201
 The Orissa Cyclone 2014
 Uttarakhand Disaster, 2013

Unit V – Case Studies of Man-Made Disaster and Media

Bhopal gas tragedy
 Chernobyl
 Holocaust
 Hiroshima

Suggested Readings

Alexievich, Svetlana, Keith, Gessen. Voices from Chernobyl: The oral history of a nuclear disaster, Picador 1997
 Benson, Charlotte and Clay, Edward. Understanding the economic and financial impacts of natural disasters, World bank publications, 2004
 Carter, W. Nick. Disaster management- A disaster manager's handbook Asian Development Bank.
 Chouhan, L.B. Alvares, Claude. Bhopal- The Inside story, Apex Press, 2004
 Dominique, Lapierre, Moro, Javier. It was five past midnight in Bhopal, HPB/FC: 1st Indian pbk. Ed, 2001
 Luite, Achyut. Understanding disaster management in practice with reference to Nepal, Practical Action, 2010.
 Mukhopadhyaya, Asim Kumar. Crisis and disaster management turbulence and aftermath, 2009.
 Sarangi, Aruna. ICTs in disaster, Neha publishers and distributors, 2010.
 Sylves, R. Disaster policy and politics: Emergency management and homeland security, CQ Press, 2008.
 Wise, Stephen. GIS Fundamentals, CRC Press, 2013.

SKILL COMPONENT

Course Code: MAC 143
Course Title: Integrated Marketing Communications

| | | | |
|----------------|-------|-------|-------|
| Credit : 6 | L - 4 | P - 2 | T - 0 |
| Marks (CIA:ES) | 30:70 | 0:50 | - |

UNIT I - Understanding Integrated Marketing Communication (IMC)

Meaning and Concept

Key Features, Objectives and Components of IMC

Theoretical Underpinnings and Models of IMC

Benefits and Barriers

UNIT II – Introduction to Business Communication

Definition and Importance of Business Communication

Business Correspondence

Business Environment in Northeast

Human Resource Management

Introduction to Advertisement & Branding

Unit III - Brand and Event Management

Branding and Designing Unique Selling Proposition

Building Image and Relations

Event Planning and Marketing

Event Risk Management

Media Business Management

Unit IV - Multimedia Technologies and Promotional tools

Understanding Promotional Mix

IMC Tools- Personal Selling

Advertising

Public Relations

Direct and Database Marketing

Sales Promotion

Online Communication/ Interactive Marketing

Event Managers

Marketing Manager

Business Development Executive

UNIT IV- IMC Plans and Campaigns

Developing IMC Plan/ Campaign Planning

Situation Analysis, Market Research and Formulating Objectives

Campaign Creation and Production

Media Planning, Selection, Budgeting and Scheduling

Unit V- Promotional Campaign Presentations

As part of the module the students in group have to analyse specific applications of marketing communication strategies. The assignment should be submitted in three parts.

First: Review of the marketing plan and promotional program

Prepare a report on the client's current market situation and their target audiences in preparation for a promotional campaign. You should include a brief company background (describing their business,

affecting the company, and a breakdown of their primary and secondary target audiences.

Second: Integrated Marketing Communications Program

Your final report should include media objectives, planning and strategy used in the promotional campaign. Taking into consideration the client's market position and audiences, discuss the various media options available and evaluate the effectiveness of using broadcast, print, or other specialist media.

Third: The Final Presentation aka The Pitch

The final presentation will be approximately 45 minutes in length. While substance is crucial, style is important, too. Please keep in mind that you are in advertising business and selling your ideas, capabilities and work are important parts of marketing.

Professional level presentations require that the group come well-rehearsed for the presentation (the use of note cards is allowed but not recommended) and complete the presentation within the allocated time. The use of PowerPoint or transparencies to highlight major points is mandatory for presentations. Handouts are also recommended to assist in the audience's ability to follow your discussion. However, if you think any of these do not fit your presentation's nature you can always convince me!

Project Group Self-Appraisal

Upon completion of the project, group members will be asked to submit a performance evaluation of each team member, including one's own self-appraisal. Each student's final grade for the project will be influenced by his or her peer evaluation score. The team member with the highest peer evaluation score will receive 100% of the grade on the final report.

Suggested readings

Kotler, Philip and Keller, Lane, *Designing and Managing Integrated Marketing Communication*
Egan J, *Marketing communication*. Thomson, 2007.

Fill C, *Marketing Communications: Interactivity, Communities and content* 5th ed., FT Prentice Hall, 2009

Pickton D & Broderick A, *Integrated marketing communications* 2nd Ed., Pearsons, 2009

Ramaswami V.S and Namakumari S, *Marketing Management, Planning, Implementation and control*, 3rd edition, Macmillan.

Business communication today, Boveen and Thill (1995), New York.

Effective business communication- Murphy and Hilderbrandt (1991), New York; McGraw Hill.

Course Code: MAC 144

Course Title: News Anchoring/ Current Affairs Analysis

Practicum

Voice Modulations

Pronunciations

Clarity Exercise

Reading Weekly News

Mock Studio Discussion on Current Affairs

| | | | |
|-------------------------|--------------|---------------|--------------|
| Credit : 6 | L - 2 | P - 4 | T - 0 |
| Marks (CIA:Proj) | - | 100:50 | - |

Course Code: MAC 145

Course Title: Publication Design and Layout

Practicum

Designing Layout for Newspaper

Layout for Magazines

Pamphlet Design

Poster Design

| | | | |
|------------------------|--------------|---------------|--------------|
| Credit : 6 | L - 2 | P - 4 | T - 0 |
| Marks (CIA:ESE) | - | 100:50 | - |

The project in group will undergo 'Project Group Self-Appraisal'

Upon completion of the project, group members will be asked to submit a performance evaluation of each team member, including one's own self-appraisal. Each student's final grade for the project will be influenced by his or her peer evaluation score. The team member with the highest peer evaluation score will receive 100% of the grade on the final report.

**SEMESTER V
GENERAL COMPONENT**

Course Code: MAC 151
Course Title: Radio Production and Journalism

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I - Growth of Radio

What is Radio?
Evolution of radio- Amateur and HAM to FM and Digital
Radio Broadcast in India

Unit II – Radio as a Tool

Participatory
Community Driven
Special Needs
Development Communication
Distress and Disaster Management

Unit III- The Grammar and Aesthetics of Radio

Radio Formats
Radio Features, Documentaries And Magazines
Writing For Radio- Idiom of the Spoken Word
Radio Journalism

Unit IV - Sound for Radio

Voice behind the Mike- Different Types of Mikes
Sound- Frequency and Wavelength
Journey to Sound-Analogue and Digital
Special Effects-Menu and Synthesis

Unit V- Production for Radio

Pre-Production- (Idea, Research, Radio Script, Storyboarding, Proposal Writing, Budget, Floor Plans, Pilot)
Production- Creative Use of Sound; Listening, Recording, Using Archived Sounds (Execution, Requisite, Challenges)
Editing, Creative Use of Sound Editing

Suggested Readings

Chatterjee, P.C. The adventures of Indian Broadcasting, Konark.
Luthra, H.R. Indian Broadcasting, Publication Division.
Mc Lish, Robert. Radio Production, Focal Press.
Saxena, Ambrish, Radio in New Avatar- AMTO FM, Kanishka Publishers, New Delhi.

Course Code: MAC 152
Course Title: The Grammar Of Documentary

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I - Introduction to Documentary

Exploring the Concept of Documentary Film
 Observational and Verity Documentary
 The Performative/Fictive in Documentary: Using Re-Enactment/Reconstruction
 Ethics and Ideology in Documentary Work

Unit II - Directing a Documentary

Researching the Documentary- Idea Generation
 Modes of Research: Library, Archives, Location, Life Stories, Ethnography
 Writing a Concept: Telling a Story, Structuring a Story,
 Proposing and Pitching a Short Documentary
 Script Writing, Treatment

Unit III - People and Techniques

The Documentary crew
 Equipment
 Scripting
 Sound for Documentary

Unit IV - Stages In Documentary Production

Production Details and Logistics
 Pre- Production
 Production
 Post Production

Unit V- Documenting Socio-Cultural Issues

Shooting Styles- Structure of A Story
 Editing Styles
 Conducting and Shooting Interviews

Suggested Readings

Badley, W. Hugh. The Techniques of Documentary Film Production, London, Focal Press
 Barnow Erik and Krishnaswamy. Documentary.
 Bernard, Sheila Curran (2004) Documentary story telling for video and filmmakers. Burlington, MA: Focal Press.
 Das, Trisha. How to Write a Documentary
 Ellis, Jack EC. A new History of Documentary Film
 Mehrotra, Rajiv. The open frame reader: Unreeling the documentary Film Ed. By PSBT
 Rabiger, Michal. Directing the Documentary.
 Renov Michael. "The truth about non-fiction" and "Towards a poetics of documentary" in Michael Renov ed. Theorizing Documentary AFI Film Readers, New York and London: Routledge, 1993.

Course Code: MAC 153
Course Title: Television Journalism

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ES) | 30:70 | - | - |

Unit I- Overview of TV Journalism

History and present perspective in television broadcasting
 Television Broadcasting system
 Understanding TV Journalism
 Organisational structure of TV news channel

Unit II- Evolution and Development of TV

The international scenario
 The Indian scenario
 Private and satellite channels
 National and international TV news agencies

Unit III- Current and Emerging Trend in TV Journalism

24/7 News
 Live News
 Convergence of media
 Digital story telling
 TV on mobile

Unit IV- Writing for Television

Research in broadcast
 Broadcast news vocabulary
 Preparation of audio and video briefs
 Writing anchor leads
 Structuring a TV news story
 Scripting for interviews/Documentary/Feature/Drama on TV

Unit V-- Practicum

Students as part of the course are to do the following exercise individually and in group as per the nature of the practical
 Different types of PTC
 Facing the camera and voice training
 Studio anchoring
 Taking vox populi
 Cover real events

Suggested Readings

Broadcast Journalism by David Keith Cohler
 Hillar; Writing for TV, Radio and New Media; 7th edition; Wadsworth
 Janet Trewin, Presenting on TV and Radio; Focal Press, New Delhi.
 MacGregor, Brent; Live, Direct and Biased; Making TV News in satellite Age.

SKILL COMPONENT

Course Code: MAC 154
Course Title: Sound Recording Techniques

| | | | |
|-----------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ES) | 30:70 | - | - |

Practicum

Radio Documentary
 Radio Jockey; Voice Modulation and Recording
 Recording Original Sound Effects

Course Code: MAC 155
Course Title: 30 Minutes Documentary

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 6 | L - 0 | P - 6 | T - 0 |
| Marks (CIA:ESE) | - | 0:150 | - |

Practicum

Documentary Prospectus- Include Detail of The Work
 Introduction of the Project
 Target Audience Research
 Background of the Project
 Description of Research Strategies
 Story Narration
 Sequence
 Shot Sizes
 Screenplay
 Audio-Visual Script
 Budget

Course Code: MAC 156
Course Title: Multimedia Production or Organizing An Event (Elective)

| | | | |
|-------------------------|--------------|--------------|--------------|
| Credit : 6 | L - 2 | P - 4 | T - 0 |
| Marks (CIA:Proj) | - | 0:150 | - |

Practicum

Studio Shooting
 Organising a College Level Event

SEMESTER VI GENERAL COMPONENT

Course Code: MAC 161
Course Title: Film Studies

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

Unit I - Introduction to Film Studies

Early Cinema- Lumiere Brothers, Georges Melies, Edwin S Porter, DW Griffith
The Journey of Indian Cinema
Film as Art
Prominent Filmmakers
Image and Meaning

Unit II - Film Moments

German Expressionism
Italian New Realism
French New Wave
Indian Parallel Cinema

Unit III - The Language of Film

Mise-en-scene
Narrative Structure
Film Semiotics
Montage

Unit IV - Film Theories

Montage theory
Realist theory
Auteur theory
Ideological Apparatus Theory

Unit V - Film Appreciation and Criticism

Learning Film Appreciation
Syntagmatic Vs Paradigmatic Analysis
Semiotic Analysis
Approaches to Film Criticism
Eastern Conceptions of Artist- Indian, Chinese and Japanese

Suggested Readings

Bazin, Andre. What is cinema? Vols 1 & 2. Berkeley & London: University of California Press, 1967, 1971.

James Monaco, How to read a film, Oxford University Press: 2009.

Nelms, J. An introduction to Film Studies, 3rd edition, London: Routledge, 2003.

Satyajit Ray, Our films and their films, 3rd edition, London: Routledge, 2003.

<http://asu.thehoot.org/research/books/environmental-journalism-and-economic-liberalisation-4510>

Course Code: MAC 162
Course Title: New Media

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

Unit I - Characteristics Of New Media

History of New Media
 Old Media Vs New Media
 Internet and WWW
 Digital Divide
 Democratization of information

Unit II - Social Media – A New Paradigm

Introduction to Growth of Social Networking Sites
 The Digital Experience- Mobile, Cyberspace, Online Apps
 Technology and Literacy Redefined- Internet, Intranet, WWW
 The User and the Fourth Screen- Representation and Reproduction

Unit III - Changing Character of Communication

Changing Tools in Media- Social Networking Sites
 Issues in Computer Mediated Communication
 The Rise of Cyborgs

Unit IV - New Media and Society

Impact of New Media on Society
 Audience Analysis and Content Planning
 Online Activism
 Cybercrime
 Ethical Dimensions of New Media

Unit V- ICT Scope and Role

New Media Technologies
 Digitization of Media
 Media Convergence
 Political Use of New Media

Suggested readings

Berger, Arthur Asa, “Media and Society: A Critical Perspective”, Rowman & Littlefield Publishers, 2007.
 Jenkins, Henry (2006) Convergence Culture: Where Old and New Media Collide. New York, London: New York University Press.
 Marshall P David (2004) New Media Cultures, Hodder Stoughton Educational. Gentile, Douglas A., “Media Violence and Children: A Complete Guide for Parents and Professionals”, Greenwood Publishing Group, 2003.
 Hassan Robert (2004) Media, Politics and the Network Society, Open University Press.
 Hassan Robert, Thomas Julian (2006) The New Media Theory Reader, Open University Press.
 Hamelink Cees J. (2001) Ethics of Cyberspace, Sage Publications.
 Hodgkinson, Paul, “Media, Culture and Society: An Introduction”, Sage Publications, 2010.
 Osgerby, Bill, “Youth Media”, Taylor & Francis, 2004.
 Warschauer Mark (2004) Technology and Social Inclusion: Rethinking the Digital Divide, MIT Press (MA).

| | | | |
|-----------------|-------|-------|-------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

Course Code: MAC 163

Course Title: Introduction to Communication Research

Unit I - Conceptualizing Research

Meaning and definition of research
 Purpose and importance of doing research
 Motivation for research
 Types of research
 Characteristic of good research

Unit II - Basics of Communication Research

Meaning and definition of Communication Research
 Research methods
 Research methodology
 Quantitative-Qualitative Approaches

Unit III – Research Processes

Research Ethics
 The Research Sequence
 Writing a Proposal: Research Question, Thesis Statement
 Generating Hypothesis
 Research objectives

Unit IV: Surveying

Survey: Schedule, Sample
 Focus Groups, Questionnaire Design
 Field Work, Telephone Polls, Online Polls
 Primary and Secondary Data

Unit V- Research and mass media

Importance of research in media
 Verification (of old facts)
 Extension (of knowledge and understanding)
 Responsibilities of a researcher

Suggested Readings

Asa Berger, Arthur, Media Research Techniques, Sage Publications, 1998
 Croteau David and Hoynes Pine, William, Media/Society: Industries, Images and Audiences Forge Press
 Kothari, C.R, Research Methodology: Methods and Techniques, New age international Ltd. Publishers
 Wimmer and Dominick, Mass Media Research Thomson Wadsworth.
 A Handbook of Media and Communication Research: Qualitative and Quantitative Methodologies By Klaus Bruhn Jensen, Routledge, 2002.
 Theory and Research in Mass Communication: Contexts and Consequences By David K. Perry, Lawrence Erlbaum Associates, 2002.

SKILL COMPONENT

Course Code: MAC 164
Course Title: Internship

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 6 | L - 0 | P - 6 | T - 0 |
| Marks (CIA:ESE) | - | 0:150 | - |

The students as part of the course have to undergo one month training in media industries, NGOs or any institutional setups during the summer break.

Course Code: MAC 165
Course Title: Short fiction film

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 6 | L - 0 | P - 6 | T - 0 |
| Marks (CIA:ESE) | - | 0:150 | - |

The students are to form a group and work on a short fiction film of 30 minutes duration.

Course Code: MAC 166
Course Title: Department news paper

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 6 | L - 0 | P - 6 | T - 0 |
| Marks (CIA:ESE) | - | 0:150 | - |

The students in a group are to work on a lab journal following a regular newspaper style.

Course Code: MAC 167
Course Title: Photography exhibition

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 6 | L - 0 | P - 6 | T - 0 |
| Marks (CIA:ESE) | - | 0:150 | - |

The students have to organize an art gallery exhibition and show case their works. The photos should be well framed and printed in high quality to be sellable to the visitors who wish to purchase the pictures.

MA POLITICAL SCIENCE SYLLABUS

List of Papers Offered: Compulsory (C) and Optional (O)

M. A. Semester I (All Compulsory)

| Paper No | Paper title |
|----------|---|
| PSC 611: | WESTERN POLITICAL THOUGHT |
| PSC 612: | INDIAN POLITICAL THOUGHT |
| PSC 613: | INDIAN POLITICS: INSTITUTIONS AND PROCESSES |
| PSC 614: | THEORIES OF INTERNATIONAL RELATIONS |

M. A. Semester II (All Compulsory)

| | |
|----------|--|
| PSC 621: | POLITICAL IDEOLOGIES |
| PSC 622: | PUBLIC ADMINISTRATION: MAJOR CONCEPTS AND ISSUES |
| PSC 623: | INDIAN POLITICS: MAJOR ISSUES AND DEBATES |
| PSC 624: | INTERNATIONAL POLITICS: MAJOR ISSUES AND DEBATES |

M.A. Semester III

Compulsory Papers:

| | |
|----------|---|
| PSC 631: | RESEARCH METHODOLOGY |
| PSC 632: | INDIAN FOREIGN POLICY |
| PSC 633: | POLITICS OF NORTH-EAST INDIA WITH SPECIAL REFERENCE TO NAGALAND |

Optional Papers:

| | |
|----------|-----------------------|
| PSC 634: | POLITICAL SOCIOLOGY |
| PSC 635: | INDIAN ADMINISTRATION |

M.A. Semester IV

Compulsory Papers:

| | |
|----------|-------------------------------------|
| PSC 641: | MA DISSERTATION |
| PSC 642: | CONTEMPORARY POLITICAL THEORY |
| PSC 643: | COMPARATIVE GOVERNMENT AND POLITICS |

Optional Papers:

| | |
|----------|--------------------------|
| PSC 644: | GENDER AND POLITICS |
| PSC 645: | INDIAN POLITICAL ECONOMY |

Semester I**Course Code: PSC 611****Course Title: WESTERN POLITICAL THOUGHT**

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Objectives:

The course will seek to comprehend the modern tradition in western political philosophy. The course will also dwell on the evolution of modern political philosophy against the backdrop of the Enlightenment tradition, covering representative thinkers in this tradition. The interpretation of these thinkers will involve striking a balance between the text and the context, and relate them to the core ideas of each thinker.

Unit I: Antiquity**Plato:** Justice, Philosopher King**Aristotle:** Politics, Justice**Unit II: Renaissance and Contractualists****Machiavelli:** Republicanism, State and Religion**Hobbes:** State of Nature, Social Contract, Leviathan**Locke:** State of Nature, Social Contract, Natural Rights**Rousseau:** Social Contract, General Will, Origin of Inequality**Unit III: Feminist Thought****Mary Wollstonecraft:** Women and Paternalism, Education**Simone de Beauvoir:** The Second Sex, Personal Freedom**Unit IV: Utilitarian****Jeremy Bentham:** Utilitarianism, Government and Reform**J. S. Mill:** Liberty, Subjection of Women**Unit V: Marxist Thought****Karl Marx:** State, Dialectical Materialism**Louis Althusser:** Ideology, State Apparatuses**Essential Readings:**

1. Barker, Ernest. (2000). *Greek Political Philosophers; Plato and his predecessors*. New York: Routledge.
2. Boucher David & Paul Kelly (Eds.). (2003). *Political Thinkers: From Socrates to the Present*. New York: Oxford University Press.
3. Coleman, J. (2000). *A History of Political Thought, Vol. 1: From Ancient Greece to Early Christianity*. Oxford: Blackwell Publishers.
4. Ebenstein (2007). *Great Political Thinkers (Plato to Present)*. New Delhi: Sterling.
5. Hacker, A. (1916). *Political Theory*, New York: Macmillan.
6. Johnson, C. (2002). *The Cambridge Companion to Mary Wollstonecraft*. Cambridge: Cambridge University Press.
7. Laski, Harold. (1920). *Political Thought in England: Locke to Bentham*. London: Home Univ. Library Service.
8. Machiavelli. (1961). *The Prince*. London: George Allen and Ulwin.
9. Macpherson. C.B. (1962). *The Political Theory of Possessive Individualism*. Ontario: Oxford University Press.
10. Mill, J.S. (1999). *Essays on Equality, Law and Education*. Toronto and Buffalo: University of Toronto Press.
11. Mukherjee, Subrata and Sushila Ramaswamy. (2002). *A History of Political Thought: Plato to Marx*. New Delhi: Prentice Hall of India.
12. Nelson, Brian R. (2006). *Western Political Thought: From Socrates to the Age of Ideology*. N. Delhi: Pearson Edn.
13. Plamentz, John. (1963). *Man and Society, Vol. II*. London: Longman Group.
14. Sabine, George. (1973). *A History of Political Thought*. New Delhi: Oxford IBH Publishing Co.
15. Skinner, Quentin. (1998). *Foundations of Modern Political Thought*. Cambridge: Cambridge University Press.
16. Wayper, C.L. (1986). *Political Thought*. New Delhi: BI Publications.
17. Wollstonecraft, M. (1929). *A Vindication of Rights of Women*. London: Everymen.

Course Code: PSC 612**Course Title: INDIAN POLITICAL THOUGHT (C)**

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Objectives:

Based on the study of individual thinkers, the course introduces a wide span of thinkers and themes that defines the modernity of Indian political thought. The course will address general themes that have been produced by thinkers from varied social and temporal Indian contexts.

Unit I: Ancient Indian Political thought

Manu – Social Laws, Statecraft

Kautilya – Statecraft, Theory of state

Unit II: Indian Renaissance

Raja Ram Mohan Roy: Socio-religious reforms

Swami Vivekananda: socio-religious views and reforms

Sayyid Ahmed Khan: Aligarh movement and religious reforms

Unit III: Gandhian Thought

Mahatma Gandhi: Satyagraha and Ahimsa, Religion and politics, Swaraj

Unit IV: Socialist Thought

Jawaharlal Nehru: Socialism, Secularism

Ram Manohar Lohia: Socialism

Jaya Prakash Narayan: Total Revolution

M. N. Roy: Radical Humanism

Unit V: Dalit and Tribal Thought

Jyotiba Phule: Education and depressed classes

BR Ambedkar: Social Justice

E. V. R. Periyar: Caste system and social reforms

Verrier Elwin: Questions over Isolation and Integration of Tribals, "Savaging the Civilized"

Essential Readings:

1. Mehta, V.R. and Pantham, Thomas (eds.) (2006) 'A Thematic Introduction to Political Ideas in Modern India: Thematic Explorations, History of Science, Philosophy and Culture in Indian civilization' Vol: 10, Part: 7, New Delhi: Sage Publications, pp. xxvii-ixi.
2. Dalton, D., (1982) 'Continuity of Innovation', in Indian Idea of Freedom: Political Thought of Swami Vivekananda, Arbindo Ghose, Rabindranath Tagore and Mahatma Gandhi. Academic Press: Gurgaon, pp. 1-28.
3. Bayly, C. A. (2010) 'Rammohan and the Advent of Constitutional Liberalism in India 1800-1830', in Kapila, Shruti (ed.) An intellectual History for India. New Delhi: Cambridge University Press, pp. 18- 34.
4. Pantham, Thomas (1986) 'The Socio-Religious Thought of Rammohan Roy', in Panthom, Thomas and Deutsch, Kenneth I. (eds.) Political Thought in Modern India. New Delhi: Sage, pp.32-52.
5. Sarkar, Sumit (1985) 'Rammohan Roy and the break With the Past', in A Critique on colonial India. Calcutta: Papyrus, pp. 1-17.
6. Sen, Amiya. P. (2003) 'Swami Vivekananda on History and Society', in Swami Vivekananda. Delhi: OUP, pp. 62- 79
7. Rustav, Hilfred (1998) 'Swami Vivekananda and the Ideal Society', in Radice, William (ed.) Swami Vivekananda and the Modernisation of Hinduism. Delhi: Oxford University Press, pp. 264- 280
8. Raghuramaraju (2007) 'Swami and Mahatma, Paradigms: State and Civil Society', in Debates in Indian Philosophy: Classical, Colonial, and Contemporary. Delhi: Oxford University Press, pp. 29-65.
9. Parel, Anthony J. (ed.) (2002) 'Introduction', in Gandhi, freedom and Self Rule. Delhi: Vistaar Publication.
10. Dalton, Dennis (1982) Indian Idea of Freedom: Political Thought of Swami Vivekananda, Aurobindo Ghose, Mahatma Gandhi and Rabindranath Tagore. Gurgaon: The Academic Press, pp. 154- 190.
11. Terchek, Ronald (2002) 'Gandhian Autonomy in Late Modern World', in Parel, Anthony J. (ed.) Gandhi, Freedom and Self Rule. Delhi: Sage.
12. Rodrigues, Valerian (2007) 'Good society, Rights, Democracy Socialism', in Thorat,

12. Rodrigues, Valerian (2007) 'Good society, Rights, Democracy Socialism', in Thorat,
13. Sukhdeo and Aryama (eds.) Ambedkar in Retrospect - Essays on Economics, Politics and Society. Jaipur: IIDS and Rawat Publications.
14. Mungekar, Bhalachandra (2007) 'Quest for Democratic Socialism', in Thorat, Sukhdeo and Aryana (eds.) Ambedkar in Retrospect - Essays on Economics, Politics and Society. Jaipur: IIDS and Rawat Publications, pp. 121-142.
15. Chatterjee, Partha (2005) 'Ambedkar and the Troubled times of Citizenship', in Mehta, V. R. and Pantham, Thomas (eds.) Political ideas in modern India: Thematic Explorations. New Delhi: Sage, pp. 73-92.
16. Pillai, R.C. (1986) 'Political thought of Jawaharlal Nehru', in Pantham, Thomas and Deutsch Kenneth I. (eds.) Political Thought in Modern India. New Delhi: Sage, pp. 260-274.
17. Zachariah, Benjamin (2004) Nehru. London: Routledge Historical Biographies, pp. 169-213.
18. Chatterjee, Partha (1986) 'The Moment of Arrival: Nehru and the Passive Revolution', in Nationalist Thought and the Colonial World: A Derivative Discourse? London: Zed Books, pp. 131-166
19. Sinha, Sachidananda, (2010) 'Lohia's Socialism: An underdog's perspective', Economic and Political Weekly, Vol. XLV, No. 40, October 02 - October 08, pp. 51-55.
20. Kumar, Anand (2010) 'Understanding Lohia's Political Sociology: Intersectionality of Caste, Class, Gender and Language Issue', Economic and Political Weekly, Vol. XLV, No. 40, October 02 - October 08, pp. 64-70.
21. Roy, R. (1991) 'The Precepts of Jesus, the Guide to Peace and Happiness', Hay, S. (ed.) Sources of Indian Tradition. Vol. 2. Second Edition. New Delhi: Penguin, pp. 24-29.
22. Verrier Elwin: The Tribal World of Verrier Elwin: An Autobiography. Oxford University Press, 1964.
23.A Philosophy for NEFA. S. Roy on behalf of the North-East Frontier Agency (NEFA), 1960.
24. Ramachandra Guha, Savaging the Civilized: Verrier Elwin, His Tribals, and India, University of Chicago Press, 1999.
25. Virginius Xaxa, State, Society, and Tribes: Issues in Post-Colonial India, Pearson, 2008.
26. Dev Nathan and Virginius Xaxa, Social Exclusion and Adverse Inclusion: Development and Deprivation of Adivasis in India, 2012, Oxford University Press
27. Archana Prasad, Against Ecological Romanticism: Verrier Elwin and the Making of an anti-Modern Tribal Identity, Three Essays Collective, 2003.
28. Tanka Bahadur Subba, SujitSom, K. C. Baral (eds.), Between Ethnography and Fiction: Verrier Elwin and the Tribal Question in India. New Delhi: Orient Longman, 2005.
29. Sharma, Suresh Kant, "The North East Frontier Agency by Verrier Elwin," Discovery of North-East India. Mittal Publications, 2005.
30. Nari Rustomji, Verrier Elwin and India's North-Eastern Borderlands, North-Eastern Hill University Publications, 1988.

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Course Code: PSC 613

Course Title: INDIAN POLITICS: INSTITUTIONS AND PROCESSES(C)

Objectives:

To enable the students to get a more nuanced understanding of Indian Politics with an effort to provide a micro picture of Indian Politics.

To understand the dynamics of the political process in India within the context of the changing nature of the Indian political system.

To provide a deeper understanding of the Indian Constitution and the working of the Legislative, Executive and Judiciary system.

Unit I: Institutional Legacies and Making of the Constitution

Historical Inheritance and Institutional Legacies

Constitutionalism in the Postcolonial Context

Making of Political Institutions

Philosophy and Major Features of the Constitution

Unit II: Institutions of Governance

Legislature: Legislation, Accountability and Representation

Executive: President, Prime Minister and Council of Ministers, Collective Responsibility and Parliamentary Accountability, Governor and Chief minister

Judiciary: Supreme Court, High Courts, Judicial Independence and Review, Judicial Activism and Overreach

Unit III: India as a Parliamentary Federation

Major Features of Indian Federalism

Centre-State Relations

Decentralization, Local Self-governing Institutions

Unit IV: Parties and Party System

National and Regional Parties, Social and Ideological Basis

Transformation of the Party System: From One Party Dominant System to Multiparty System

Coalition Governments and Coalition Politics at the National and State Level

Unit V: An Overview of Statutory and Semi- Judicial Bodies

Planning Commission, NitiAayog, Election Commission of India, Central Information Commission, Vigilance Commission, Comptroller and Auditor General, Lok Pal and LokAyukta.

Essential Readings:

1. Austin, Granville. 1966. *The Indian Constitution: Cornerstone of a nation*. Oxford: Clarendon Press, chapter 1, 2, 3 and 4.
2. Dasgupta, Jyotirindra. 2001. "India's federal design and multicultural national construction," University Press/ Foundation, chapter 3.
3. Jha, Shefali. 2008. "Rights versus representation: Defending minority interests in the Constituent Assembly," in Rajeev Bhargava (ed.) *Politics and ethics of the Indian Constitution*. New Delhi: Oxford University Press, pp.339-353.
4. Khosla, Madhav. 2013. *The Indian Constitution*. New Delhi: OUP short introduction series.
5. Kothari, Rajni. 1970. *Politics in India*. New Delhi: Orient Longman, chapter 2.
6. Sarkar, Sumit. 2001. "Indian democracy: The historical inheritance," in Kohli (ed.). *The success of India's democracy*, chapter 2. Readings: Unit III
7. Arora, Balveer et al. 2013. "Indian federalism," in K.C. Suri (ed.) *ICSSR research surveys and explorations: Political Science: Indian Democracy, Volume 2*. New Delhi: Oxford University Press.
8. Arora, Balveer. 1995. "Adapting federalism to India: Multilevel and asymmetrical and innovations," in Douglas V. Verney and Balveer Arora (eds.). *Multiple identities in a single state: Indian federalism in comparative perspective*. New Delhi: Konark.
9. Mathur, Kuldeep. 2013. *Panchayati Raj*. New Delhi: OUP short introduction series
10. Singh, Mahendra P. and Douglas V. Verney. 2003. "Challenges to India's centralised parliamentary federalism," *Publius* 33(4), pp.1-20.
11. Tummala, Krishna K. 2007. "Developments in Indian federalism: 2005–2007," *Asian Journal of Political Science* 15 (2), pp.139-160.
12. Kothari, Rajni. 1964. "The Congress 'system' in India," *Asian Survey* 4(12), pp.1161-73.
13. Kothari, Rajni. 1970. "Continuity and change in India's party system," *Asian Survey* 10(11), pp.937-48.
14. Sridharan, 1999. "Coalition politics in India: Lessons from theory, comparison and recent history" in D. D. Khanna and Gert W. Kueck (eds.). *Principles, power and politics*, New Delhi: Macmillan India.
15. Sridharan, E. 2005. "Coalition strategies and the BJP expansion, 1989-2004," *Commonwealth and Comparative Politics* 43(2), pp.194-221.
16. Sridharan, E. 2010. "Party system," in Jayal and Mehta (eds). *The Oxford companion to politics in India*, pp.117-138.
17. Suri, K.C. 2005. *Parties under pressure: Political parties in India since independence* (paper presented for a project on State of democracy in South Asia. Delhi: CSDS). Available online: www.democracy-asia.org/qa/india/KC%20Suri.pdf
18. Yadav, Yogendra and SuhasPalshikar. 2006. "Party system and electoral politics in the Indian states, 1952-2002: From hegemony to convergence," in Peter Ronald deSouza, and E. Sridharan (eds.) *India's political parties*. New Delhi: Sage, pp.73-115.
19. Bagchi, Amaresh. 2007. "Role of planning and the Planning Commission in the new Indian economy," *Economic and Political Weekly*, 42(44), pp.92-100.
20. Bhagat, Anjana K. 1996. *Elections and electoral reforms in India*. New Delhi: Vikas, pp.23-102.
21. McMillan, Allister. 2010. "The Election Commission" in Jayal and Mehta (eds.), *Oxford companion to politics in India*, pp. 98-116.

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|-----------------|-------|-------|-------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Course Code: PSC 614

Course Title: THEORIES OF INTERNATIONAL RELATIONS(C)

Objectives:

- This course introduces students to some of the most important theoretical approaches for studying international relations.
- It provides a comprehensive overview of the major political developments and events starting from the twentieth century in order to equip them with the tools to understand and analyze the same from different perspectives.

Unit I: Growth and Development of International Relations

Concept of International Relations

Development of International Relations as an academic discipline

Unit II: Approaches of International Relations

- Realism and Neo- Realism
- Classical Liberalism and Neo- Liberalism

Unit III: Alternative Approaches

Constructivism

Marxism

Feminism

Post- Modernism

Unit IV: Structural Realism

Nation- State in a Globalized world

Sources of Conflict and Co- operation

Power and Rivalry

Unit V: Perspectives on International Economy

Mercantilism

Liberal Perspective on IPE

Contemporary Debates

Essential Reading:

1. C.O, Large & A.A Said(1972) Concept of International Politics, Prentice hall.
2. Carr, E.H(1939) The 20 Years of Crisis, London Macmillan
3. DeutschK.W(1989)The Analysis of International Relations, New Delhi, Prentice Hall.
4. H.Bull(1961)The Control of the Arms Race, New York, Draeger.
5. Kennan, G(1998)The Nuclear Delusion, New York, Pantheon books.
6. Malhotra, Vinay Kumar & Alexander,ASergounin(1998)Theories and Approaches to International Relations. Anmol Publications Pvt. Ltd New Delhi
7. NorthedgeF.S(1976)The International Political System, London, Faber a Faber, 1976
8. P.Allan and K. Goldman (eds.)(1992) The End of the Cold War, Dordrecht, MartinusNijhoff.
9. Piever-Marie,Martin(1993)(Edited by J.C Johari) Introduction to International Relations. Sterling Publishers, New Delhi.
10. R.Aron (1966)Peace and War : A Theory of International Relations, London Fontana.
11. Rosenau J.N,(1976) World Politics-An Introduction, New York,
12. -----(1980)The Scientific Study of Foreign Policy, Princeton
13. S. Bruchil(2001) Theories of International Relations, Hampshire, Macmillan
14. Theodore, A. Couloumbis& James H. Walfe(1986) Introduction to International Relations: Power and Justice. Publish by Prentice Hall of India, New Delhi
15. W.Epstein(1971)Disarmament: 25 Years of Effort, Toronto, Canadian Inst. Of International Affairs.

Additional Readings:

1. Chris Brown and Kirsten Ainley, Understanding International Relations 4th edition, (London: Palgrave Macmillan, 2009).
2. Scott Burchill et al (eds.), Theories of International Relations 4th edition (London: Palgrave, 2009).
3. Patrick Jackson, The Conduct of Inquiry in International Relations (London: Routledge, 2010)
4. Martin Griffiths (ed.), Encyclopaedia of International Relations and Global Politics (London: Routledge, 2007).
5. Walter Carlsnaes, Thomas Risse and Beth Simmons (eds.), Handbook of International Relations, 2nd edition (London: Sage, 2012).
6. Christian Reus-Smit and Duncan Snidal (eds.), The Oxford Handbook of International Relations (Oxford: Oxford University Press, 2010).
7. C.A. Bayly (2004) The Birth of the Modern World (Oxford: Blackwell).
8. Barry Buzan and Richard Little (2002) 'Why International Relations Has Failed as an Intellectual Project and What to Do About It', Millennium 30(1): 19-39.
9. Barry Buzan and Richard Little (2000) International Systems in World History (Oxford: Oxford University Press): especially parts II and III.

SEMESTER II (All Compulsory)**Course Code: PSC621****Course Title: POLITICAL IDEOLOGIES**

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Objectives:

- The purpose of the course is to provide a systematic, comprehensive, comparative and critical introductory understanding and examination of the concept of ideology in the history of modern political thought.
- The focus of the course is to understand some of the core political ideologies such as: liberalism, nationalism, fascism, socialism and communism in strict and direct relation with the main sources (texts and interpretations), and also to offer an outline for the different aspects of several contemporary ideologies.

Unit I: Political Ideology: Conceptual Introduction and Typologies of Interpretations**Unit II: Liberalism and Conservatism****Unit III: Socialism and Communism****Unit IV: Fascism, Nazism and Anarchism****Unit V: Nationalism****Essential Readings:**

1. Daniel Bell, The end of Ideology, New York, Colliers, 1961.
2. J. Plamentaz, Ideology, London, 1970.
3. H Lubasz, Fascism; Three Major Regimes, New York: Willey & Sons, 1973.
4. S. Kaviraj and Others: The State of Political Theory: Some Marxist Essays, Calcutta, Research India Publication, 1971.
5. L.T. Hobhouse, Liberalism, New York, Oxford University Press, 1964.
6. Germino, Dante Beyond Ideology; The Revival of Political Theory, New York, Harper, 1967.
7. H.M Drucker, The Political Uses of Ideology, London, Macmillan, 1974.
8. M. Cranston, (ed.), The New Left, London, Bodley Head, 1970.
9. Kolakowski, Main Currents in Marxism, Oxford Clarendon Press, 1978.
10. Andrew Vincent, Modern Political Ideologies, Oxford, Blackwell, 1996.
11. Hans Kohn, The Idea of Nationalism ; A Study in its Origin and background, New York, Macmillan, 1945.
12. E. Kamenka, (ed.), Nationalism : The Nature and Evolution of an Idea, London, Edward Arnold, 1976.
13. David Mclellan, Ideology, Milten Keynes, Open University Press, 1986.
14. Martin Seliger, Ideology and Politics, London, Alen& Unwin, 1976.

Course Code: PSC 622

Course Title: PUBLIC ADMINISTRATION: MAJOR CONCEPTS AND ISSUES

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Objectives:

- The course provides an introduction to the discipline of public administration with an emphasis on administrative theories, including non-western developing country perspectives.
- An understanding of the classical theories, approaches and principles of administration is provided along with praxiological understanding of contemporary administration and policy concerns.

Unit I: Introduction and Concepts: Meaning, Nature and Scope; Public and Private Administration; Relevance and Importance of Public Administration.

Unit II: Paradigms of Public Administration: New Public Administration; Development Administration, New Public Management; New Public Service, Good Governance; Feminist Perspective.

Unit III: Theoretical Approaches: Scientific Management; Bureaucratic Management; Human Relations; Decision Making; Ecological Approach.

Unit IV: Principles of Organisation: Hierarchy; Span of Control; Unity of Command; Co-ordination; Line and Staff Agencies, Auxiliary Agencies.

Unit V: Personnel Administration: Recruitment; Training; Generalist and Specialist in Administration; Administrative Ethics (Corporate Social Responsibility); Relationship between Politics and Administration.

Essential Readings:

1. Avasthi and Maheshwari. (2009). *Public Administration*. Agra: Lakshmi NarianAgarwal.
2. Basu, Rumki. (2001). *Public Administration: Concepts and Theories*. N. Delhi: Sterling Publishers.
3. Bhagwan, Vishnoo and VidyaBhushan. (2011). *Public Administration*. N. Delhi: S. Chand.
4. Bhambri, C.P. (1990). *Public Administration*. Meerut: Jai PrakashNath& Co.
5. Bhattacharya, Mohit. (2012). *Public Administration*. Kolkata: The World Press Pvt. Ltd.
6. ----- (2008). *New Horizons of Public Administration*. New Delhi: Jawahar Publishers.
7. Chakrabarty, B & Mohit Bhattacharya. (2004). *Administrative Change and Innovation: A Reader*. New Delhi: Oxford University Press.
8. Dror, T. (1989). *Public Policy Making Reexamined*. Oxford: Transaction Publication.
9. Dye, Thomas. (1984). *Understanding Public Policy*. U.S.A: Prentice Hall.
10. Goel, S.L. (2003). *Advanced Public Administration*. New Delhi: Deep & Deep.
11. ----- *Public Administration: Theory and Practice*. N. Delhi: Deep & Deep.
12. Henry, Nicholas. (1999). *Public Administration and Public Affairs*. Prentice Hall.
13. Maheshwari, S.R. (2013). *Administrative Theories*. New Delhi: Allied Publishers.
14. Medury, Uma. (2010). *Public Administration in the Globalisation Era*. N. Delhi: Orient Blackswan.
15. Menon, Nivedita (Ed.). (1999). *Gender and Politics*. New Delhi: Oxford University Press.
16. Rathod, P.B. (2004). *Contemporary Public Administration: Ideas and Issues*. Jaipur: ABD.
17. Riggs, F.W. (1964). *Administration in Developing Countries: The Theory of Prismatic Society*.
18. ----- (1961). *The Ecology of Public Administration, Part 3*. New Delhi: Asia Publishing House.
19. Sharma, M.P., L. Sadana & Harpreet Kaur. (2011). *Public Administration in Theory and Practice*. Allahabad: Kitab-Mahal.
20. Singh, A. (2002). *Public Administration: Roots and Wings*. New Delhi: Galgotia Publishing Company.
21. Stivers, Camilla. (2002). *Gender Images in Public Administration*. New Delhi: Sage Publishers.
22. Walby, Sylvia. (1997). *Theorising Patriarchy*. Oxford: Basil Blackwell.

Course Code: PSC 623

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Course Title: INDIAN POLITICS: MAJOR ISSUES AND DEBATES

Objectives:

- To provide a deeper understanding on the important features of the Indian political system.
- To update the students about changes and new trends in Indian polity.
- To develop the skills of debate / discussion among the students pertaining to the issues surrounding Indian Politics.

Unit I: India's Democracy

Working a Democratic Constitution: A History of the Indian Experience

Political Mobilization and Democracy in India

Major perspectives on Indian Politics: Liberal, Marxist, Subaltern and Feminist: Western and Indian

Unit II: Federalism

Centre-State Relations: Tension Areas and Issues

Regionalism and State Movements: Accommodation or Integration?

Language, Region, and Ethnicity: Demand for Separate States; Salience of Regional Parties at the National and State Level

Unit III: Communalism and Secularism

The Role of Religion in Politics; Secularism

Debates on Nationalism, Communalism, and Minorities

Unit IV: The Politics of Identities in India

Caste Politics: Politics and Mobilization

Class Politics: The changing Nature of Class Dominance in India; Middle Class: Old and New

Ethnic Politics: Domination, recognition, mobilization and social justice

Unit V: Civil Society and the State

State, society and Democracy in India: A historical overview

State–Civil Society relationship in India: Major debates

Social Movements

Assessing Indian State and Democracy

Essential Readings:

1. Chatterjee, Partha. 2010. "The state," in NirajaGopalJoyal and PratapBhanu Mehta (eds). The Oxford companion to politics in India. New Delhi: OUP, pp.3-14.
2. Das, Samir Kumar. 2013. "Introduction: Surveying the literature on state in post-Independence India," in Samir Kumar Das (ed.). ICSSR research surveys and explorations: Political Science, Vol.1. New Delhi: ICSSR/Oxford University Press.
3. Gupta, SobhanLalDatta. 2013. "Social Character of the Indian state: A survey of current trends," in .
4. Menon, Nivedita and Aditya Nigam. 2007. Power and contestation: India since 1989. New Delhi: Zed.
5. Mitra, Subrata. 2008. "When area meets theory: Dominance, dissent, and democracy in India," International Political Science Review 29(5), pp.557–78.
6. Basu, Amrita. 2010. "Gender and Politics," in Joyal and Mehta (eds). The Oxford companion to politics in India, pp.168-80.

7. Deshpande, Ashwini. 2013. *Affirmative action in India*. New Delhi: OUP short introduction series.
8. Fernandes, Leela and Patrick Heller. 2006. "Hegemonic aspirations: New middle class politics and India's democracy in comparative perspective," *Critical Asian Studies*, 38(4), pp.495-522.
9. Guha, Ramchandra. 1996. "Savaging the civilized: Verrier Elwin and the tribal question in late colonial India," *Economic and Political Weekly* 31(35/37), pp.2375-80+2383+2385-89.
10. Guru, Gopal "Social justice," in Jayal and Mehta (eds). *The Oxford companion to politics in India*, pp.361-80.
11. Harris, John. 2010. "Class and politics," in Jayal and Mehta (eds). *The Oxford companion to politics in India*, pp.139-54.
12. Jhodka, Surinder. 2010. "Caste and politics," in Jayal and Mehta (eds). *The Oxford companion to politics in India*, pp.154-67.
13. Jodhka, Surinder Singh. 2013. *Caste*. New Delhi: OUP short introduction series
14. Pai, Sudha. 2013. *Dalit assertion*. New Delhi: OUP short introduction series.
15. Shah, Ghanshyam (ed.). 2001. *Dalit identity and politics*. New Delhi: Sage.
16. Xaxa, Virginius. 2005. "Politics of language, religion and identity: Tribes in India," *Economic and Political Weekly*, 40 (13).
17. Austin, Granville. 1966. "Language and the constitution: The half-hearted compromise," in Granville Austin. *The Indian constitution: cornerstone of a nation*. Oxford: Clarendon Press.
18. Baruah, Sanjib. "Regionalism and Secessionism," in Jayal and Mehta (eds). *The Oxford companion to politics in India*, pp.181-92.
19. Chandhoke, Neera, 2006. "A state of one's own: Secessionism and federalism in India," Discussion paper no.80. London: Development Research Centre, Crisis States Programme, DESTIN, LSE, September.
20. Kaviraj, Sudipta. 2010. "Writing, speaking, being: Language and the historical formation of identities in India," in Sarangi (ed.), *Language and politics in India*, chapter 9.

Additional Reading:

1. Chandhoke, Neera. 2007. "Civil society," *Development in Practice* 17(4/5), pp.607-14.
2. Kaviraj, Sudipta. 2001. "In search of civil society," in SudiptaKaviraj and Sunil Khilnani. *Civil society: History and possibilities*. Cambridge: Cambridge University Press, pp.287-323.
3. Kothari, Smitu. 1993. "Social Movements and the redefinition of democracy" in Philip Oldenburg (ed.). *India briefing*. Boulder: Westview Press.
4. Mohanty, Manoranjan and Partha NathMukherji (eds.). 1998. *People's rights: Social movements and the state in the Third World*. New Delhi: Sage.
5. Shah, Ghanshyam (ed.). 1999. *State and social movements*. New Delhi: Sage Readings: Unit VI
6. Kohli, Atul. 2006. "Politics of economic growth in India 1980-2005: Part I" *Economic and Political Weekly*, 41(13), April 1, pp.1251-59.
7. Kohli, Atul. 2006. "Politics of economic growth in India 1980-2005: Part II" *Economic and Political Weekly*, 41(14), April 8, pp.1361-70.
8. Nayar, Deepak. 2006. "India's unfinished journeys: Transforming growth into development," *Modern Asian Studies* 40 (3), pp.797-832.
9. Rudolph, Lloyd I., and Susanne Hoeber Rudolph. 2001. "Iconisation of Chandrababu: Sharing Sovereignty in India's Federal Market Economy," *Economic and Political Weekly* 36(18), pp.1541-52.
10. Sachs, Jeffrey, Ashutosh Varshney and NirupamBajpai (eds). 2000. *India in the era of economic reforms*. New Delhi: OxfordUniversity Press.
11. Sinha, Aseema. 2010. "Business and politics," in Jayal and Mehta (eds). *The Oxford companion to politics in India*, pp.459-77.
12. Suri, K.C. 2006. "Political economy of agrarian distress." *Economic and Political Weekly* 41(16), 1523-29.
13. DeSouza Peter R., SuhasPalshikar and YogendraYadav. "Surveying South Asia, 2008", *Journal of Democracy*, Vol. 19, No. 1, January, pp. 84-95.
- Ganguly, Sumit. 2007. "Six decades of independence." *Journal of Democracy* 18(2), pp.30-40.

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|-----------------|-------|-------|-------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Course Code: PSC 624

Course Title: INTERNATIONAL POLITICS: MAJOR ISSUES AND DEBATES

Objectives:

- The aim of this course is to introduce the students to the contemporary issues and debates in International politics.
- The students would be also made to acquaint themselves with the dimensions of the making of foreign policy as well as the role of Non- State Actors in World Politics.
- The emerging New World Order and the challenges to it would also be dealt with in detail.

Unit I: International Politics: Historical Perspectives

- History of World Wars
- Cold War: Bipolarism to Unipolarism to Multipolarism

Unit II: Disarmament, Arms Race and Arms Control

- Partial Test Ban Treaty
- Nuclear Non-Proliferation Treaty
- Comprehensive Test Ban Treaty
- Deterrence and Détente
- Nuclear Weapons and Weapons of Mass Destruction

Unit III: United Nations: A Critical Appraisal

- Reformation of the United Nations
- Millennium Development Goals
- United Nations and Regionalism

Unit IV: Contemporary Challenges

- Global Social Movements
- Climate Change
- Global Terrorism
- Human Rights

Unit V: Globalization and Financial Institutions

- Globalization and International Political Economy
- World Bank
- International Monetary Fund
- World Trade Organisation
- Neo-colonialism: Role of Transnational Corporations

Essential Readings:

1. Baylis John and Steve Smith, 2005, The Globalization of World Politics, London, OUP
2. Kegley Jr. Charles W. and Eugene R. Wittkopf, 2005, World Politics: Trend and Transformation, Belmont, Thmont, Thomson Wodsworth.
3. Nicholson Michael, 2005, International Relations: A Concise Introduction, New York, Palgrave-Macmillan
4. -----, 2005, Causes and Consequences in International Relations, New York, Palgrave-Macmillan
5. Sorensen George, 2001, Changes in Statehood-The transformation of international Relations,
6. Hampshire, Palgrave
7. Leibfried Stephan and Michael Zurn, 2005, Transformations of the State, Cambridge, CUP
8. Clark Ian, 1999, Globalization and International Relations theory, Oxford, OUP
9. -----, 1997, Globalization and Fragmentation: International Relations in the twentiethcentury, Oxford, OUP
10. -----2005, Legitimacy in International Society, Oxford, OUP

Semester III**Course Code: PSC 631****Course Title: RESEARCH METHODOLOGY**

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Objectives:

- To impart the concept, techniques, tools and types of research to students.
- To familiarise the students with the different stages of research such as Research Design, Data Collection, Data Handling, Data Analysis and Academic Writing.
- To develop skills related to the use of Information Technology, library resources, and empirical work in research. These are being done with an aim to instil in the students the art of presentation of academic and research reports.

Unit 1: Research in Social Sciences: Meaning, Characteristics and Types; Nature and Process of Research, Selection and Formulation of Research Problem

Unit 2: Research Design: Exploratory, Explanatory and Descriptive studies; Testing of Hypothesis; Problems of Measurement; Test of variables

Unit 3: Data Collection: Observational Method (participant and non-participant); Questionnaires; Sampling; Interviews (Scheduled, Telephonic, Social Networking); Use of Primary and Secondary Sources

Unit 4: Analysis and Interpretation of Data: Sources; Acquisition; Quantitative and Qualitative Data; Graphical Representation and Mapping of Data; Information and Communication Technology (ICT) - Uses, Meaning, Advantages; MS Excel

Unit 5: Research Writing and Presentation: Development of Writing and Communication Skills in Writing and Presenting seminars; Report, Academic Paper and Dissertation Writing: its Characteristics and Format; Use of Internet in Research Work; Research Ethics (Issues of professional ethics, Plagiarism and Copyright), References and Bibliography

Essential Readings:

1. Ahuja, Ram. (2008). *Research Methods*. Delhi: Rawat Publishers.
2. Bernard, Russell H. (2000). *Social Research Methods*. N. Delhi: Sage.
3. Burgess, Robert G. (1996). *Key Variables in Social Investigation*. London: Routledge &Kegan Paul.
4. Janet, Johnson & Richard Joslyn. (1987). *Political Science Research Methods*. New Delhi: Prentice Hall.
5. Kothari, S.R. (2008). *Research Methodology: Methods and Techniques*. New Delhi: New Age International (P) Ltd., Publishers.
6. Miller, Robert L & John D. Brewer. (2003). *The A- Z of Social Research*. New Delhi: Sage Publications.
7. Srivastava, Vinay Kumar. (Ed.). (2005). *Methodology and Field Work*. New Delhi: Oxford Univ. Press.
8. Newman W. Lawrence. (2007). *Social Research Methods*. New Delhi: Pearson Edn.
9. Oliver, Paul. (2010). *Writing Your Thesis, Second Edition*. New Delhi: Sage Publications.
10. Shapiro, Ian, Smith & Masoud. (Eds.). (2004). *Problems and Methods in the Study of Politics*. Cambridge: Cambridge Univ. Press.

Course Code: PSC 632

Course Title: INDIAN FOREIGN POLICY (C)

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Objectives:

- The course introduces the key determining principles of India's Foreign policy to students. It highlights the central realities, issues and developments pertaining to India's foreign policy at the bilateral, regional and global levels.
- The course also imparts an understanding of India's role in global economic and political regimes. It apprises students of the major security challenges facing the country in the 21st century and India's stand on these issues.

UNIT 1: India's International Relations: Introduction

- India's Foreign Policy: Origins and Determinants.
- Nonalignment: Definition; India's role in Non Aligned Movement (NAM)

UNIT II: India's 'Immediate Neighbourhood'

- India's Relations with the SAARC Countries
- India's Relations with China

UNIT III: India's 'Extended Neighbourhood'

- India's Relations with the ASEAN Countries
- India's Relations with Middle East Countries
- India and Regional Integration

UNIT IV: India's Great Power Relations

- India's Relations with Soviet Union/Russia
- India's Relations with the European Union
- India's Relations with the USA

UNIT V: India and Global Issues

- India and the United Nations
- India and the Indian Diaspora
- India and International Terrorism
- India and Nuclear Weapons
- India and Climate Change

Essential Readings:

1. A. Rana, 'Understanding International Conflict in the Third World: A Conceptual Enquiry', in K. Bajpai and S. Mallavarapu (eds), International Relations in India. Theorising the Region and Nation, New Delhi: Orient Longman, 2004.
2. S. Neuman (ed.), International Relations Theory and the Third World. An Oxymoron? New York: St Martin's Press, 1998
3. A. Acharya and B. Buzan, 'On the Possibility of a Non-Western IR Theory in Asia', International Relations of the Asia-Pacific, Vol. 7, No. 3, 2007.
4. N. Behera, 'Re-imaging IR in India', International Relations of the Asia-Pacific, Vol. 7, No. 3, 2007.
5. Behera (ed.), International Relations in South Asia: Search for an Alternative Paradigm, New Delhi: Sage Publications, 2008.
6. R. Zaman, 'Kautilya: The Indian Strategic Thinker and Indian Strategic Culture', Comparative Strategy, Vol. 25, No. 3, 2006.
7. K. Bajpai, 'Introduction', in K. Bajpai and S. Mallavarapu (eds), International Relations in India. Theorising the Region and Nation, New Delhi: Orient Longman, 2004.
8. D. Hagerty, 'India and the Global Balance of Power: A Neorealist Snapshot', in H. Pant (ed.), Indian Foreign Policy in a Unipolar World, New Delhi: Routledge, 2009.
9. S. Cohen, India: Emerging Power, Washington: Brookings Institution Press, 2001;
- B. Buzan, 'South Asia Moving Towards Transformation: Emergence of India as a Great Power', International Studies, Vol. 39, No. 1, 2002.
- S. Ganguly (ed.), India as an Emerging Power, London: Frank Cass, 2003;

10. B. Buzan, 'South Asia Moving Towards Transformation: Emergence of India as a Great Power', *International Studies*, Vol. 39, No. 1, 2002.
11. S. Ganguly (ed.), *India as an Emerging Power*, London: Frank Cass, 2003;
12. B. Nayar and T. Paul, *India in the World Order: Searching for Major Power Status*, Cambridge: Cambridge University Press, 2003
13. N. Subramanian, 'India's Great Power Plans', *The Diplomat*, 29 March 2010.
14. R. Sikri, *Challenge and Strategy. Rethinking India's Foreign Policy*, New Delhi: Sage, 2009
15. S. Gordon, *India's Rise to Power in the Twentieth Century and Beyond*, New York: St Martin's, 1995
16. N. Rajadhyaksha, *The Rise of India: Its Transformation from Poverty to Prosperity*, New Delhi: Wiley India, 2006
17. M. Kamdar, *Planet India: The Turbulent Rise of the World's Largest Democracy*, London: Simon & Schuster Ltd, 2007
18. H. Pant, *Contemporary Debates in Indian Foreign and Security Policy: India Negotiates its Rise in the International System*, New York: Palgrave Macmillan, 2008;
19. S. Sanyal, *The Indian Renaissance: India's Rise After a Thousand Years of Decline*, New Delhi: Penguin, 2008;
20. D. Rothermund, *India: The Rise of an Asian Giant*, New Haven: Yale University Press, 2009.
21. S. Ganguly, *Conflict Unending: India-Pakistan Tensions Since 1947*, New York: Oxford University Press, 2002.

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Course Code: PSC 633

Course Title: POLITICS OF NORTH-EAST INDIA WITH SPECIAL REFERENCE TO NAGALAND

Objectives:

- To assess the colonial legacy in the North East India and their impacts.
- To introduce the social and Political movements in the Post – independent India with special reference to mobilization politics like movements for the formation of states, identity based movements and movements related to development issues in North East India.
- To analyze the presence of asymmetrical federalism in Nagaland and the contentious issues surrounding it and; the emerging challenges and issues in Nagaland.

Unit I: History and Profile of North East

- a. Conceptualization of the category of North East
- b. Historical and Political features: Geo-Political significance and importance
- c. British Administration and Regulations over North East

Unit II: Reorganization of North Eastern States and Constitutional Provisions

- a. Constituent Assembly Debates
- b. Bordoloi Committee
- c. Sixth Schedule
- d. Reorganization of the Composite State of Assam: Creation of New States and Union Territories

Unit III: Political and Economic Issues and debates in North-East

- a. Political Movements and Inter-ethnic Conflicts: Ethnic Diversities and Identity Assertion
- b. Conflict Resolution in North East: The Politics of Peace Accords
- c. Economic Development in North-East: MDONER and Act (Look) East Policy: Towards Inclusive Development; The North-Eastern Council: From an Advisory to a Regional Planning Body

Unit IV: Statecraft and Asymmetrical Federalism

- a. Exploring Modern Democracy in Nagaland: Creation of the State of Nagaland and Areas of Tension and Challenges
- b. The Nature and Implications of Special Constitutional Provisions and Political issues: 371(A), Integration of Naga Inhabited Areas, Inter-state Border Disputes, AFSPA
- c. Exploring the Naga Experience with Modern Electoral Democracy

Unit V: Contemporary Challenges and Issues of Nagaland

- a. Engendering Democracy in Nagaland: Questions of Women's Rights and Empowerment
- b. Inter-Tribal Politics and Its Consequences for the Naga Society
- c. Naga Traditional Customary Laws and Practices: Transforming a Tribal Society
- d. Exploring State-Society Relations: Conflict and Conflict Resolution-Role of Civil Society Organisations in Nagaland

Essential Readings:

1. Barpujari, H.K. (1976) Problems of the hill tribes of North-East India, Vol. I, II, III BuxutiPrakash, Guwahati.
2. Baruah Sanjib(2000) Durable Disorder, OUP
3. ----- (series ed.),(2004) Between South and Southeast Asia: Northeast India and The Look East Policy.Published by Centre for Northeast India, South and Southeast Asia Studies. OKDISCD Guwahati.
4. ----- (2008) India Against Itself Assam and The politics of Nationality ,OUP
5. Bhuyan B.C. (ed.)(1992)Political Development of the North-East. Vol.11,Omson's Publications N.Delhi
6. Bose M.L.(1979) Historical and Constitutional Development of North East India, New Delhi
7. Chaube, S.K.(1974) Hill Politics of North-East India, Orient Longman, Kolkata.
8. Chakravorty, B.C.(1981) British Relations with Hill Tribes of Assam Since 1885, Kolkata.
9. Charles, Reuben Lyngdoh& Morning star Rani (eds),(2008) Look East Policy Impact On Northeast India, Akansha Publishing House, New Delhi.
10. Dubey, S. M (ed.)(1978)North-East India. A Sociological Study, Concept Publishing, Delhi.
11. Elvin, V. (1969)Nagas in the Nineteenth Century, Shillong.
12. Girin, Phukon (ed.)(2000)Political Dynamics of North-East India, South Asian.
13. Girin, Phukon (ed.)(2005) Inter-Ethnic Conflict in Northeast India, South Asian Publishers.
14. Goswami, Atul,(2002) Traditional Self-Governing Institutions Among The Hill Tribes of North-East India .
15. Jha,GangaNath and Nani Bath(2000) India and South-East Asia-Reviving Traditional Bonds of Friendship in Nalini Kant Jha (ed) India's Foreign Policy in a Changing World. Essays in Honour of Professor Bimal Prasad. South Asian Publishers N.Delhi
16. Karna M.N., Gassah L.S., Thomas C.J. (eds) (1998)Power to People in Meghalaya. (Sixth Schedule and the 73rd Amendment) Regency Publications N.Delhi
17. Rao, V.V.(2000)A Century of Tribal Politics in North-East India, S Chand & co., Delhi,
18. ShibaniKinkar Chaube, Hill Politics in North East India
19. HK Barpujari, North-East india: Problems, Policies and Prospects, Spectrum,Guwahati, 1998.

OPTIONAL (O) PAPERS:**Course Code: PSC 634****Course Title: POLITICAL SOCIOLOGY (O)**

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Objectives:

- Politics as a process has, institutional and non – institutional dimensions. From this perspective, the main purpose of this course is to explore the non – institutional political processes, and thereby, sensitize the students on the informal processes of politics. This will highlight the social context of politics and project how politics can be also an outcome of non- political processes.
- The course also attempts to provide a deeper understanding of the concepts and approaches related to the discipline of political sociology.

Unit I: Introduction: Nature and Scope of Political Sociology**Unit II: Basic Concepts:** Political Culture; Popular Culture; Political Socialization; Power and Authority; Consensus and Conflict; Elites and Masses; State and Stateless Societies**Unit III: Democracy Classification:** Democracy in the West and the East**Unit IV: Politics and Society in India:** Ideology and Consensus; Social Character of the Indian State**Unit V: Local Level Politics:** Local Government; Roots of contemporary Indian politics; Popular participation and popular politics in India**Essential Readings:**

1. Almond, Gabriel & S. Verba. (1963). *The Civic Culture*. Princeton: Princeton University Press.
2. Aloysius, G. (1997). *Nationalism without a Nation*. Oxford: Oxford University Press.
3. Baker, Gideon. (2002). *Civil Society and Democratic Theory: Alternative Voices*. London: Routledge.
4. Bayly, S. (1999). *Caste, Society and Politics in India from the Eighteenth Century to the Modern Age*. Cambridge: Cambridge University Press.
5. Beteille, A. (Ed.). (1983). *Equality and Inequality: Theory and Practice*. Delhi: Oxford University Press.
6. Bottomore, Tom. (1979). *Political Sociology*. London: Hutchinson of London.
7. Brass, P.R. (1985). *Caste, Faction and Party in Indian Politics, Vol. 2*. Delhi: Chaanakya Publications.
8. Dash, SatyaPrakash. (2001). The State, Civil Society and Democracy: A Note. *The Indian Journal of Political Science*, 62(2): 240-251. Retrieved from <http://www.jstor.org/stable/42753670>
9. Foucault, Michel. (1982). *The Subject and Power*. *Critical Inquiry* 8(4): 777-795.
10. Gledhill, John. (2000). *Power and Its Disguises: Anthropology Perspectives on Politics*. London: Pluto Press, 2nd Edition.
11. Gordon, Colin (Ed.). *Power/Knowledge: Selected Interviews and Other Writings 1972- 1977, Michel Foucault*. New York: Pantheon Books.
12. Goswami, B.B. (Ed.). (1997). *Ethnicity, Politics and Political Systems in Tribal India*. Calcutta: Anthropological Survey of India.
13. Kohli, Atul (2001). *The Success of India's Democracy*. New York: Cambridge University Press.
14. Kothari, Rajni (1970). *Caste in Indian Politics*. Hyderabad: Orient Longman.
15. ----- (1970). *Politics in India*. New Delhi: Orient Longman.
16. ----- (1976). *Democratic Politics and Social Change in India*. New Delhi: Allied Publishers.
17. Hasan, Zoya. (Ed.). (2000). *Politics and the State in India*. New Delhi: Sage.
18. Held, David. (1987). *Models of Democracy*. Stanford: Stanford University Press.
19. Joseph, Sarah. Society vs State? Civil Society and Non-Party Political Process in India. *Economic and Political Weekly*, 37 (4) 299-305.

Course Code: PSC 635**Course Title: INDIAN ADMINISTRATION (O)**

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Objective:

- The main focus of this course is to enhance the students' understanding about the structure and function of the administrative system in India. The course will examine the evolution of the Indian administrative system and also engage on the debate regarding the idea on continuity and change.
- The course will examine in detail the administrative system that operates at the Union, State and District level.
- It will also cover a study about the emergence and the growth of the public services in India as well as the various statutory institutions and commissions.

Unit I: INTRODUCTION TO INDIAN ADMINISTRATION

- Ancient & Medieval
- Mughal Administration
- Colonial Legacy
- Post Colonial Context
- Debates on Continuity & Change

Unit II: Union Administration

- Structure
- Cabinet Secretariat
- Prime Minister's Office
- Central Secretariat
- Ministries and Departments

Unit III: State and District Administration

- Governor
- Chief Minister and Council of Ministers
- Structures of Administration- Secretariat & Directorate with special reference to the role of Chief Secretary

Unit IV: Public Services in India

- All India Services: UPSC
- State Services: SPSCs
- Lateral Entry
- Administrative Reforms

Unit V: Statutory Institutions and Commissions

- National Commission for Minorities
- National Commission of Scheduled Castes
- National Commission of Scheduled Tribes
- National Commission for Women

Essential Readings:

1. Arora K. Ramesh, Rajni Goyal (1995) Indian Administration- Institutions and Issues. New Age International, New Delhi.
2. Barthwal, C.P. (1993) Public Administration in India – Retrospect and Prospects. Ashish Publishing House, New Delhi
3. Chakrabarty Bidyut (2007) Reinventing Public Administration- The Indian Experience. Orient Black Swan.
4. Datta, Prabhat (2006) Decentralisation, Participation & Governance. Kalpaz. New Delhi
5. Jayapalan N (2001) Indian Administration, Volume I & II. Atlantic Publishers, 2010
6. Jeevan Nair & U.C Jain (2000) The Indian Bureaucratic System. Pointer Publishers, 2000
7. K.C Sivaramakrishnan K.C (2000) Power to the people: The Politics & Progress of Decentralisation. Konark Publishers, New Delhi
8. K.S Padhy & P.K Muni (1987) Corruption in Indian Politics, Discovery Publishing House, 1987
9. Maheswari S.R (1979) State Governments in India. Macmillan
10. ----- (2013) Indian Administration. Orient Blackswan, New Delhi.
11. ----- (2006) Public Administration in India – The Higher Civil Service. Oxford University Press.
12. R.K (1885) Civil Service in India. Deep and Deep Publication, New Delhi.
13. Ramachandran Padma (1995) Public Administration in India. National Book Trust, 1995
14. Sharma P.D & B.M Sharma (2009) Indian Administration- Retrospect & Prospect. Rawat Publishers, Jaipur.
15. Sapru R.K (1994) Development Administration. Sterling Publishers. New Delhi.
16. Singh Satyajit & Pradip Sharma (2007) (Ed) Decentralisation Institutions & Politics in Rural India, Oxford .
17. Vepa, K. Ram (1978) Change and Challenges in Indian Administration. Manohar, New Delhi

SEMESTER IV**Course Code: PSC 641****Course Title: Dissertation***Topic and content to be decided in consultation with the Departmental Research Committee and the Student Concerned.*

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 0 | P - 4 | T - 0 |
| Marks (CIA:ESE) | - | 0:100 | - |

Course Code: PSC 642**Course Title: CONTEMPORARY POLITICAL THEORY (C)**

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Objectives:

- The course aims to equip the students in understanding the different theories / concepts of politics.
- The course deals with the normative aspects of politics highlighting the various themes under study within the context of emerging trends evolving from the praxis.

Unit I: Contemporary Political Theory:

a. Issues of Rights, Liberty, Equality and Justice

Unit II: Mainstream Political Theory

- a. Liberal Theory
- b. Democratic Theory

Unit III: Critical Theory

- a. Critical Theory: First /Second/Third Generations
- b. Postmodern/Poststructural Theory
- c. Feminist Theory

Unit IV: Radical Political Theory

- a. Anarchist Theory
- b. Postcolonial Theory

Unit V: Recent Trends in Political Theory;

- a. Communitarianism
- b. Cosmopolitanism
- c. Multi-Culturalism
- d. Ecologism

Essential Reading:

1. A. de Crespigny and K. Minogue (eds)(1975) Contemporary Political Thinkers, London,
2. Parekh, (1982) Contemporary Thinkers, Oxford Martin Robertson.
3. Bhikhu Parekh (ed)(2000) Rethinking Multiculturalism. Cultural Diversity and Political Theory Palgrave New York
4. Catriona Mckinnon (ed)(2009) Issues in Political Theory .OUP
5. Colin Farrelly (ed) (2007)Contemporary Political Theory A Reader , Sage Publications
6. David Boucher & Paul Kelly (eds)(2009) Political Thinkers- From Socrates to the Present(Second edition), Oxford University Press
7. Daniel Bell (ed), (1962)The End of Ideology, On the Exaustion of Political Ideas in the Fifties with "The Resumption of History in the New Century". Harvard University Press
8. Fukuyama Francis (ed)(2014)Political Order and Political Decay: From the Industrial Revolution to the Globalisation of Democracy. Farrar, Straus and Giroux PublishingCompany. New York
9. Fukuyama Francis (ed),(2006) The End of History and the Last Man. Free Press, New York
10. Fukuyama Francis & Patricia L.Maclachlan (eds)(2004), State Building: Governance and World Order in the 21st Century (2004). Cornwell University Press
11. J.C.Johari (1996)Contemporary political Theory .
12. Mathew Festenstein&Micheal Kenny (eds) (2005)Political Ideologies. OUP
13. M.H Lessnoff, (1999)Political Philosophers of the 20th Century Oxford, Blackwell.
14. P.Franco (ed)(1990) The Political Philosophy of Michael Oakshott New Haven CT, Yale Univ. Press
15. Paul Schumaker (ed) (2010)The Political Theory Reader, Blackwell PublishingLtd.

Additional Reading:

1. James Tully, "Political Philosophy as a Critical Activity," *Political Theory* Vol. 30, No. 4, (Aug., 2002), pp. 533-555.
2. John Rawls, "The Idea of Public Reason Revisited," *The University of Chicago Law Review*, Vol. 64, No. 3 (Summer, 1997), pp. 765-807.
3. Isaiah Berlin, "Two Concepts of Liberty" In *Four Essays on Liberty*. Oxford: Oxford University Press.
4. Jeremy Waldron, "Theoretical Foundations of Liberalism," *The Philosophical Quarterly* Vol. 37, No. 147 (Apr., 1987), pp. 127-150.
5. Will Kymlicka, "Liberalism and Minorities Rights: An Interview" *Ratio Juris* 12 (2)1999: 133-152.
6. Anne Phillips, Anne. "Democracy and Difference: Some Problems for Feminist Theory" *Political Quarterly*, Volume 63, Issue 1, January 1992: 79-90.
7. Sandel, Michael. "The Procedural Republic and the Unencumbered Self" *Political Theory* Vol. 12, No. 1 (Feb., 1984), pp. 81-96
8. G. A. Cohen, "Where the Action Is: On the Site of Distributive Justice" *Philosophy and Public Affairs* 26 (1):3-30 (1997)
9. C.W. Mills, "Rawls on Race/Race in Rawls" *The Southern Journal of Philosophy*(2009) Vol. XLVII
10. Jurgen Habermas, "Three Normative Models of Democracy" *Constellations* 1(1)1994.
11. Seyla Benhabib, "Toward a Deliberative Model of Democratic Legitimacy" in Seyla Benhabib (ed.), *Democracy and Difference*, Princeton, 1996.

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Course Code: PSC 643**Course Title: COMPARATIVE GOVERNMENT AND POLITICS (C)****Objectives:**

- To introduce to the students the comparative understanding of the working of Government and its institutions in the first as well as Third World countries from praxiological perspectives.
- To make them aware of the dynamics of the institutional & non institutional politics of the countries under consideration.
- To enable the students to identify the communities and differences in the working of different political systems arising thereof.

Unit I: Meaning, Nature and Scope of Comparative Politics**Unit II: Approaches to Comparative Politics:** Behavioural; Post- Behavioural; Marxist**Unit III: Theoretical Perspectives:** Systems; Structural- Functionalism; Political Culture; Political Socialization**Unit IV: Themes for Comparative Analysis: Forms of Government** - Presidential (USA), Parliament (UK)- Federal (USA), Unitary (UK)**a. Legislature** - Unicameral (China), Bicameral (USA)**b. Executive** - President and Cabinet (USA), Prime Minister and Cabinet (UK)**c. Judiciary** - Supreme Court of USA and India**Unit V: Political Party Systems** - One Party: China, Two Party: USA, UK, Multi- Party: India.**Essential Readings:**

1. Almond, Gabriel A. et al. (2011). *Comparative Politics Today: A World View*. New Delhi: Pearson Education.
2. Ball, Alan and Guy Peters, B. (2000). *Modern Politics and Government*. London: Macmillan.
3. Bhagwan, Vishnu and Vidya Bhushan. (1999). *World Constitutions*. New Delhi: Sterling Publishers.
4. Easton, David. (1953). *The Political System: An Inquiry into the State of Political Science*. Cambridge: Cambridge University Press.
5. Finer, S.E. (1974). *Comparative Government*. Harmondsworth: Penguin.
6. Held, David (1998). *Political Theory Today*. Oxford: Political Press.

7. Held, David (Ed.). *Political Theory and Modern State*. Delhi: Worldview.
8. Johari, J.C. (2009). *Comparative Government and Politics*. New Delhi: Sterling Publishers.
9. ----- (2006). *New Comparative Government*. New Delhi: Lotus Press.
10. Mahler, G.S. (2008). *Comparative Politics: An Institutional and Cross- National Approach*. New Delhi: Pearson Education.
11. Sartori, G. (1976). *Party and Party System: A Framework for Analysis*. Cambridge: Cambridge University Press.
12. Varma, S.P. (2004). *Modern Political Theory*. N. Delhi: Vikas Publishing House.

Course Code: PSC 644

Course Title: GENDER AND POLITICS (O)

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Objectives:

- The course aims to examine the issues of patriarchal power relations operating at different levels of society and contemporary debates on feminism within the history of feminist struggles.
- The course also focuses on an understanding of the Indian society, economy and polity with a view to understand the structures of gender inequalities and their impacts on contemporary Indian Polity.

Unit I: Patriarchy: Concepts and Issues

Unit II: Feminism: Theoretical Perspectives; Liberal, Marxist, Radical; Difference Approach, Identity Feminism; Third World Feminism; Transfeminism; Waves of Feminism

Unit III: The Politics of Gender: Family, Community, State

Unit IV: Gender and Constitutional Provisions: Constitutional and Legal Rights of Women in India

Unit V: Political Participation of Women: Women in Decision Making Bodies

Essential Readings:

1. Agarwal, Bina. (1994). *A Field of one's Own Gender and Land Right's in South Asia*, Cambridge: Cambridge University Press
2.(Ed.). (1988), *Structures of Patriarchy: State, Community and Household in Asia*. New Delhi: Kali
3. Bakshi, S.R. (2002). *Empowerment of Women and Politics of Reservation*. Jaipur: Book Enclave
4. S. Beavour, Simone De. (1988). *The Second Sex*. London: Picador
5. Bhargava, R & A. Acharya. (Eds.). (2008) *Political Theory: An Introduction*. Delhi: Pearson
6. Bryson, Valerie. (1992). *Feminist Political Theory*. Bristol: Polity Press
7. Burns. Nancy. Schlozman, Kay Lehman & Verba, Sidney. 2001), *The Private Roots of Public*
8. *Action: Gender, Equadlity and the Potmied Participation*. London: Harvard University Press
9. Butler, Judith & Joan Scott. (Eds.) (1992). *Feminists Theorise the Political*. New York Routledge
10. Chakravarty, U. (2003). *Gendering Caste through a Feminist Lens*. Kolkata: Stree
11. Chhibber, Pradeep. (2002). *Why are some Women Politically Active? The Household, Public*
12. *Space, and Political Participation in India*. *International Journal of Comparative Sociology* Sage Publications Retrieved from tiopen and politics
13. Desai, Neera & Thakkar, Usha. (2004), *Women in Indian Saciery*. New Delhi: National BookTrust
14. Engels, F, *Origin of Family and Private Property and the Stat*
15. Geetha, V. (2007): *Theorising Feminism: Patriarchy, Kolkotta*
16. Gilligan, Carol (2003). *In a Different Voice: Psychological Theory and Women's*
17. *Development*. Cambridge: Harvard University Press
18. Hasan, Zoya. (1994), *Forging identines Gender, Communities und the State*. New Dellhi
19. Holmes, Mary. (2007). *What is Gender in Sociological Approaches*. New Delhi: SagePublications
20. Khanna, Manuka. (2009). *Political Participation of Women in India*. *The Indian Journal of Political Science*, LXX(1) 54-64, Ret

21. Kosambi. M. (2007), Crossing the Threshold. New Delhi: Permanent Black
22. MacKinnon, Catherine. (1989) Towards a Feminist Theory of State. London: Harvard University Press, retrieved from <http://www.jstor.org/stable/41856495>
23. Menon, Nivedita. (Ed.). (1999), Gender and Politics in India. New Delhi: Oxford University Press
24. Millet, Kate (2002): Sexual Political. Urbana: Univ of Illinois Press
25. Mill, J.S. On Liberty and the Subjection of men. Delhi: Sage Publications
26. Nelson, B & N. Chowdhury. (Eds) (1997) Women and Politics Worldwide Delhi: Oxford Univ. Press.
27. Rao, Nitya. (2008). Good Women do not Inherit Land. New Delhi: Orient Blackswan

Course Code: PSC 645

Course Title: INDIAN POLITICAL ECONOMY (O)

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 25:75 | - | - |

Objectives:

- The economy of a nation plays a crucial role in conditioning the patterns of politics in a given society. From this perspective, this course aims to understand the impact of political economy on the political process in India.
- The course also aims at acquainting the students with the significant political economy issues such as liberalization / changing configuration of class / patterns of development in influencing the politics of India.

Unit I: Approaches to Indian Political Economy

- a. Classical Liberalism
- b. Marxism
- c. Welfarism
- d. Neo-liberalism and
- e. Gandhian Approach

Unit II: Democracy and Economic Development: Shaping and Consolidation of Economic Policies

- a. The Discourse on Development, Economic Growth and Sustainable Development
- b. Social Indicators in a Comparative Perspective, Social Implications and Patterns of Inequality

Unit III: Politics of Economic Growth: The Era of Planned Development

- a. The Planning Commission and the National Development Council
- b. Industrial and Agricultural Policies
- c. Land Reforms
- d. Poverty Alleviation Programmes

Unit IV: Politics of Economic Growth: The New Economic Policy

- a. New Economic Reforms: Liberalization, Privatization, Globalisation
- b. From Planning Commission to NITI Aayog
- c. Public Private Partnership
- d. A Critical Appraisal of New Economic Policy

Unit V: Interface of Politics and Economics: Changing Role and Priorities of the State

- a. Politics, Poverty and Redistribution
- b. Politics of Rapid Economic Growth
- c. Regional Disparities

Essential Readings:

1. Arblaster, A. (2006) 'The Rise and Decline of Western Liberalism' in Lal, D. *Reviving the Invisible Hand: The Case for Classical Liberalism in the Twenty first Century*. Princeton: Princeton University Press, pp. 1-8, 17- 30, and 48- 51.
2. Mandel, E. (1979) *An Introduction to Marxist Economic Theory*. New York: Pathfinder Press, 3rd print, pp. 3-73.
3. Kersbergen, K.V. and Manow, P. (2009) *Religion, Class Coalition and Welfare State*. Cambridge: Cambridge University Press, chapters 1 and 10, pp. 1-38; 266-295
4. Andersen, J. G. (ed.) (2008) 'The Impact of Public Policies' in Caramani, D *Comparative Politics*. Oxford: Oxford University Press, ch 22, pp. 547- 563.
5. Harvey, D. (2005) *A Brief History of Neo-liberalism*. Oxford: Oxford University Press, pp. 1- 206.
6. Ghosh, B.N. (2007) *Gandhian Political Economy: Principles, Practice and Policy*. Ashgate Publishing Limited, pp. 21- 88.
7. Bagchi Amiya, ed., *Democracy and Development*, Macmillan, Basingstoke, 1995.
8. Dreze Jean and Amartya Sen, *India: Development and Participation*, Oxford University Press, New Delhi, 2002.
9. Frankel Francine, *India's Political Economy*, Oxford University Press, New Delhi, 2005.
10. Haq Mahbulul, *Reflections on Human Development*, Oxford University Press, Delhi, 1999.
11. Weiner Myron, 'Political Economy of Industrial Growth in India' in *World Politics*, July 1986.
12. Bagchi Amiya ed., *Economy, Society and Polity: Essays in the Political Economy of Indian Planning*, Oxford University Press, New Delhi, 1980.
13. Bandyopadhyay D., 'Land Reforms in India', *Economic and Political Weekly*, June 2128,1986

Additional Readings:

1. Bardhan Pranab, *The Political Economy of Development in India*, Oxford University Press, Delhi, 1984.
2. Byres Terence J., eds., *The State and Development Planning in India*, Oxford University Press, Delhi, 1994.
3. Chakravarty S., *Development Planning: The Indian Experience*, Oxford University Press, Delhi, 1987.
4. Harris John, 'Comparing Political Regimes across Indian States', in *Economic and Political Weekly*, Nov 27, 1999.
5. Kohli Atul, *The State and Poverty in India: The Politics of Reform*, Cambridge University Press, Cambridge, 1987.
6. Bardhan Pranab, 'Disjunctures in the Indian Reform Process: Some Reflections' in Basu Kaushik, ed., *India's Emerging Economy*, The MIT Press, Cambridge, 2004.
7. Basu Kaushik, ed., *India in the Era of Economic Reforms*, Oxford University Press, New Delhi, 2003.
8. Harris John, *Depoliticising Development*, Leftword, Delhi, 2004.
9. Jenkins Rob, *Democratic Politics and Economic Reforms in India*, Cambridge University Press, Cambridge, 1999.
10. Sachs Jeffrey et al., eds., *India in the Era of Economic Reforms*, Oxford University Press, Delhi, 1999.
11. Agarwal Bina, *A Field of One's Own: Gender and Land Rights in South Asia*, Cambridge University Press, Cambridge, 1994.
12. Bardhan Pranab, 'Decentralization of Governance and Development', *The Journal of Economic Perspectives*, 16:4, Autumn 2002.
13. Jayal Niraja Gopal, Amit Prakash, Pradeep K Sharma., eds., *Local Governance in India: Decentralization and Beyond*, Oxford University Press, New Delhi, 2006.

MSC GEOLOGY SYLLABUS

SEMESTER I

GEO611: Mineralogy, Crystallography and Analytical Techniques

GEO612: Palaeontology

GEO-613: Structural Geology and Tectonics

GEO614: Geochemistry and Thermodynamics

SEMESTER II

GEO621: Igneous and Metamorphic Petrology

GEO622: Sedimentology

GEO623: Ore Geology

GEO624: Principles of Stratigraphy and Indian Stratigraphy

GEO628: Field Training

SEMESTER III

GEO631: Engineering geology and Hydrogeology

GEO632: Resource Geology

GEO633: Geomorphology and Remote sensing

GEO634: Mineral Exploration and Mining geology

SEMESTER IV

GEO641: Environmental Geology

GEO642: Special Paper

GEO643: Dissertation

SEMESTER I**THEORY****Course Code: GEO 611****Course Title: Mineralogy, Crystallography and Analytical Techniques**

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: A detailed study of following mineral groups with reference to their general formulae, classification, atomic structure, chemistry, experimental work with special reference to P-T stability and mode of occurrence and paragenesis:

- a) Nesosilicates - Olivine group; Garnet group; Aluminosilicate group (kyanite, andalusite and sillimanite).
- b) Cyclosilicates - Beryl
- c) Inosilicates - Pyroxene group; Amphibole group.
- d) Phyllosilicates - Kaolinite group; Serpentine group; Pyrophyllite, talc; Mica group; Chlorite group.
- e) Tectosilicates - Feldspar group; Cordierite.
- f) Sulfides, Halides, Sulfo-salts, Oxides, Hydroxides and Carbonates

UNIT – 2: Nature of light, Polarisation, Double refraction, Nicol prism. Isotropic, uniaxial and biaxial indicatrices. Extinction: nature and types. Pleochroism and pleochroic schemes. Interference colours and interference figures. Determination of optic sign of uniaxial and biaxial minerals, optic angle (2V).

UNIT – 3: Crystallography and its importance in mineralogy. Introduction to 32 classes of symmetry, description of holosymmetric class of various crystal systems, international system of crystallographic notation; Different types of crystal projections-spherical and stereographic, and their uses.

Symmetry of internal structures – concept of point group, space group, Bravais lattices and lattice defects; Twinning and twin laws, common types of twins and their examples in minerals; Liquid crystals and their applications.

UNIT – 4: Development of X-ray crystallography and Bragg's equation, powder method in X-Ray crystallography; Electron probe micro analysis and scanning electron microscopy - principle, application and their utility in mineral sciences; Introduction to ion microprobe analysis and infra-red spectroscopy; Chemical properties of minerals-isomorphism, solid solution, polymorphism and pseudomorphism.

Books Recommended:

1. Berry, L.G., Mason, B. and Dietrich, R.V. (1982): Mineralogy, CBS Publ.
2. Dana, E.S. and Ford, W.E. (2002): A textbook of Mineralogy (Reprint).
3. Kerr, P.F. (1977): Optical Mineralogy, McGraw Hill.
4. Moorhouse, W.W. (1951): Optical Mineralogy, Harper and row Publ.
5. Nesse, D.W. (1986): Optical Mineralogy, McGraw Hill.
6. Perkins, D. (1998): Mineralogy, Prentice Hall.
7. Phillips, F.C (1971): Introduction to Crystallography, Longman Group Publ.
8. Winchell, E.N. (1951): Elements of Optical Mineralogy, Wiley Eastern.
9. Deer, W.A., Howie, A.A. and Zussman, J., 1996: *The Rock Forming Minerals*. Longman.
10. Klein, C. and Hurlbut, Jr., C.S., 1993: *Manual of Mineralogy*. John Wiley.
11. Putnis, Andrew, 1992: *Introduction to Mineral Sciences*. Cambridge University Press.
12. Spear, F.S. 1993: *Mineralogical Phase Equilibria and Pressure -Temperature-Time Paths*. Mineralogical Society of America Publ.

Course Code: GEO 612
Course Title: Palaeontology

| | | | |
|-----------------|-------|-------|-------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: General principles of palaeontology: Origin of life through time and space; modern systematic, concept and kind of specimens, species, speciation and adaptive radiation. Micro- and macro- evolution. Trace fossils, their classification and palaeo-environmental significance.

UNIT – 2: Functional morphology and evolutionary trends in mollusks (Pelecypoda, Gastropoda, Cephalopoda), brachiopoda, Echinodermata and trilobites. Vertebrate fossil records of Siwaliks. Mesozoic Reptiles and Evolution of Man. Dinosaurs and their extinction. Classification of fossil plants and broad characters of major plant groups.

UNIT – 3: Classification, morphology and palaeoecological significance of Foraminifers, Ostracods and Conodonts. Morphology, classification and biogeography of Radiolarians. Use of microfossils in interpretation of sea floor tectonism. Application of micropalaeontology in hydrocarbon exploration.

UNIT – 4: Morphology, classification and application of pollen and spores. Morphology, Environmental application and stratigraphic significance of dinoflagellates, Calcareous nannofossils and Calcareous algae. Type of Organic matters; Palynofacies and its application in palaeoenvironment interpretation.

Books Recommended:

1. Clarkson, E.N.K., 1998: *Invertebrate Palaeontology and Evolution*. IV Ed. Blackwell.
2. Stearn, C.W. & Carroll, R.L., 1989: *Palaeontology -the Record of Life*. John Wiley.
3. Smith, A.B., 1994: *Systematics and the Fossils Record*-Documenting Evolutionary Patterns. *Blackwell*.
4. Prothero, D.R., 1998: *Bringing Fossils to Life -An Introduction to Palaeobiology*. *McGraw Hill*.
5. Pomeroy, C., 1982: *The Cenozoic Era: Tertiary and Quaternary*. Ellis Harwood Ltd.
6. Bigot, G. (1985). *Elements of Micropalaeontology*. Graham & Trotman, Paris.
7. Kethal, P.K. (1998). *Microfossils and their applications*. CBS Publishers & Distributors.
8. Jones, R.W. (1998). *Micropalaeontology in petroleum exploration*. Oxford University Press.
9. Brooks, J. (1981). *Organic Maturation studies and fossil fuel exploration*. Academic Press.
10. Traverse, A. (1994) *Sedimentation of organic particles*. Cambridge University Press.
11. Foote, M & Miller, A.I. (2001). *Principles of Palaeontology*. W.H. Freeman & Company.
12. Doyle, P. (2002). *Understanding fossils an introduction to invertebrate palaeontology*. Wiley
13. Jones, R.W. (2006). *Applied palaeontology*. Cambridge University Press.
14. Brasier, M.D. (1980). *Microfossils*. Unwin Hyman, London.
15. Traverse, A (2007). *Palaeopalynology*. Springer.
16. Haslett, S.K. (2002). *Quaternary environmental micropalaeontology*. Arnold.
17. Ravindra Kumar – *Fundamental of Historical Geology and Stratigraphy of India*
18. Ray, A.K. (2008). *Fossils in Earth Sciences*. Prentice Hall of India Private Limited, New Delhi.
19. Skelton, P.W., Spicer, R.A., Keller, S.P. and Gilmour, L. (2003). *The Cretaceous world*. Cambridge University Press.

Course Code: GEO 613
Course Title: Structural Geology and Tectonics

| | | | |
|-----------------|-------|-------|-------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: Concept of stress and strain. Two dimensional strain and stress analysis. Types of strain ellipses and ellipsoids; their properties and geological significance. Strain markers in naturally deformed rocks. Mechanical principles and properties of rocks and their controlling factors. Theory of rock failure.

UNIT – 2: Description and geometric classification of folds. Mechanisms and mechanics of folding and buckling. Buckling of single layer, multilayer and anisotropic materials. Fold development and distribution of strain in folds. Analysis and interpretation of superimposed folding. Fault bent folds, gravity induced structures and salt diapirism.

UNIT – 3: Description and classification of faults and joints. Mechanics of faulting and jointing, and stress conditions for thrust, normal and strike-slip faults. Mechanics and geometric aspects of thrust, normal and strike-slip faults, and associated structural features. Use of faults in estimating crustal stretching and shortening. Concept of balanced section. Analysis of joints with reference to major structures and palaeo-stress studies. Planar and linear fabrics (Foliation and Lineation): description, classification, genesis and significance. Petrofabric analysis: concept, preferred orientation developed under various geologic conditions.

UNIT – 4: Concept of tectonics/geotectonics, Broad geotectonic division of Indian subcontinent. Concept of palaeomagnetism and its outcome: continental drifting, polar wandering, polarity reversals, magnetostratigraphy and concept of plate tectonics. Structural, tectonic/geotectonic, seismic and gravity features of the three plate margins – constructive, conservative and consuming.

Books Recommended

1. Badgley, P.C., 1965: *Structural Methods for Exploration Geologists*. Harper and Row.
2. Ramsay, J.G., 1967: *Folding and Fracturing of Rocks*. McGraw Hill.
3. Hobbs, B.E., Means, W.O. and Williams, P.F., 1976: *An Outline of Structural Geology*, John Wiley.
4. Davis, G.R., 1984: *Structural Geology of Rocks and Region*. John Wiley.
5. Ramsay, J.G. and Huber, M.I., 1987: *Modern Structural Geology*, Vol. I & II. Academic Press.
6. Price, N.J. and Cosgrove, J.W., 1990: *Analysis of Geological Structure*. Cambridge Univ. Press.
7. Bayly B., 1992: *Mechanics in Structural Geology*. Springer Verlag.
8. Ghosh S.K., 1995: *Structural Geology: Fundamentals of Modern Developments*. Pergamon Press.
9. Twiss, R.J. and Moores, E., 1992: *Structural Geology*.
10. Park, R.G., 1989: *Foundation of Structural Geology*.
11. Billings, M.P: *Structural Geology*.
12. Suppe, John: *Principles of Structural Geology*.

Course Code: GEO 614
Course Title: Geochemistry and Thermodynamics

| | | | |
|-----------------|-------|-------|-------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: Origin and abundance of elements in the solar system and in the earth, and its constituents.

Geochemical classification of elements. Meteorites, their classification, mineralogy and their origin. Utility of trace elements in petrogenesis of rocks. Interpretation of REE patterns.

UNIT – 2: Radiogenic isotopes. Radioactive decay schemes of U-Pb, Sm-Nd, Rb-Sr, K-Ar, and growth of daughter isotopes. Radiometric dating of single minerals and whole rocks. Stable isotopes: nature, abundance and fractionation. Chemical kinetics in geosciences and its application: disequilibrium. Textures and diffusion.

UNIT – 3: Concept of free energy, activity, fugacity and equilibrium constant. Principles of ionic substitution in minerals; element partitioning in mineral/rock formation and concept of simple distribution coefficients and exchange reaction distribution coefficients; element partitioning in mineral assemblages and its use in the pressure-temperature estimation.

UNIT – 4: Redox reactions and mineral stability in Eh-pH diagram. Rock weathering and soil formation. Elemental mobility in surface environment. Concept of geochemical-biogeochemical cycling. Sampling procedures and introduction to important analytical techniques used in geochemistry

Books Recommended:

1. Powell, R. (1978): Equilibrium thermodynamics in Petrology: An Introduction, Harper and Row Publ., London.
2. Rastogy, R.P. and Mishra, R.R. (1993): An Introduction to Chemical Thermodynamics, Vikash Publishing House.
3. Spear, F. S. (1993): Mineralogical Phase Equilibria and pressure – temperature – time Paths, Mineralogical Society of America.
4. Wood, B.J. and Fraser, D.G. (1976): Elementary Thermodynamics for Geologists, Oxford University Press, London.
5. Perchuk, L.L. and Kushiro, I. (eds), 1991: *Physical Chemistry of Magmas*. Springer Verlag.
6. Bloss, F.D. (1971): Crystallography and Crystal Chemistry, Holt, Rinehart, and Winston, New York.
7. Evans, R.C., (1964): Introduction to Crystal Chemistry, Cambridge Univ. Press.
8. Hoefs, J. (1980): Stable Isotope Geochemistry, Springer-Verlag.
9. Klein, C. and Hurlbut, C.S. (1993): Manual of Mineralogy, John Wiley and Sons, New York.
10. Krauskopf, K.B. (1967): Introduction to Geochemistry, McGraw Hill.
11. Mason, B. and Moore, C.B. (1991): Introduction to Geochemistry, Wiley Eastern.
12. Rollinson, H.R. (1993): Using geochemical data: Evaluation, Presentation, Interpretation. Longman U.K.
13. Shikazono, N. (2003): Geochemical and Tectonic Evolution of Arc-Backarc Hydrothermal Systems - Implication for the Origin of Kuroko and Epithermal Vein-Type Mineralizations and the Global Geochemical Cycle, Elsevier Science.

PRACTICALS**Course Code: GEO 615****Course Title: Mineralogy, Crystallography and Analytical Techniques**

Study of important rock forming minerals with reference to their diagnostic physical properties. Determination of pleochroic scheme of certain minerals, extinction angle and birefringence of minerals, using accessory plates. Interference figures and determination of optic sign of uniaxial and biaxial minerals. Determination of optic axial angle - 2V of important minerals. Identification of important rock-forming minerals in thin section using diagnostic optical properties.

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| Credit : 2 | L - 0 | P - 2 | T - 0 |
| Marks (CIA:ESE) | - | 10:40 | - |

Course Code: GEO 616**Course Title: Palaeontology**

Recognition of fossil groups in an assorted assemblage and identification of their classes. Study of important fossils from Indian stratigraphic horizons. Study of morphological features, systematic classification and stratigraphic age of Mollusks, Brachiopods, Echinodermata, Trilobites of invertebrate fossils. Identification of important Calcareous, Siliceous, phosphate and organic walled microfossils, plant fossils and vertebrate fossils.

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| Credit : 2 | L - 0 | P - 2 | T - 0 |
| Marks (CIA:ESE) | - | 10:40 | - |

Course Code: GEO 617**Course Title: Structural Geology and Tectonics**

Preparation and interpretation of geological maps and sections. Structural problems concerning economic mineral deposits. Recording and plotting of field data, and construction of traverse map. Problems on stereographic and orthographic projections. Plotting and interpretation of petrofabric data and resultant diagrams: p-, b- and contour diagrams. Study of large scale tectonic features of the Earth.

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| Credit : 2 | L - 0 | P - 2 | T - 0 |
| Marks (CIA:ESE) | - | 10:40 | - |

Course Code: GEO 618**Course Title: Geochemistry and Thermodynamics**

Calculation of mineral formulae from the concentration of various oxides in minerals. Calculation of normative minerals from rock composition. Presentation of analytical data. Estimation of pressure and temperature from important models of geothermometry and geobarometry.

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| Credit : 2 | L - 0 | P - 2 | T - 0 |
| Marks (CIA:ESE) | - | 10:40 | - |

SEMESTER II**THEORY****Course Code: GEO 621****Course Title: Igneous and Metamorphic Petrology**

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: Nature and evolution of magma. Plate tectonics and generation of magmas; plume magmatism and hot spot. Phase rule and phase equilibria study of single, binary and ternary systems, and their relations to magma genesis and crystallization in the light of modern experimental works; Interpretation of igneous textures in terms of rate of nucleation and crystal growth.

UNIT – 2: IUGS classification of the igneous rocks and CIPW norm; Rock suite, petrographic provinces and associations. Petrology and petrogenesis of major igneous rock types with Indian examples of ultramafic, komatiite, basalt, granite, alkaline rocks, ophiolite, carbonatite, lamprophyre and kimberlite.

UNIT – 3: Mineralogical Phase Rule of closed and open systems. Metamorphic facies: description of each facies of low, medium to high pressure and very high pressure with special reference to characteristic metamorphic zones and subfacies: Albite-epidote-hornfels, Hornblende-hornfels, Pyroxene-hornfels, Greenschist, Granulite and Eclogite. Metamorphic reactions and pressure – temperature conditions of metamorphism.

UNIT – 4: Isograds and reaction isograds; Schriener's rule and construction of petrogenetic grids; Metamorphic differentiation, anatexis and origin of migmatites in the light of experimental studies; Regional metamorphism of various rock types; Pressure – temperature – time paths.

Books Recommended:

1. Turner, F.J. 1980: *Metamorphic Petrology*, McGraw Hill, New York.
2. Yardley, B. W. 1989: *An Introduction to Metamorphic Petrology*. Longman New York.
3. Bucher, K. and Frey, M. 1994: *Petrogenesis of Metamorphic Rocks*, Springer -Verlag.
4. Blatt, H. and Tracy, R.J. (1996): *Petrology (Igneous, Sedimentary, Metamorphic)*, W.H. Freeman and Co., New York.
5. Philpotts, A.R. (1994): *Principles of Igneous and Metamorphic Petrology*, Prentice Hall.
6. Spry, A. (1976): *Metamorphic Textures*, Pergamon Press.
7. Winter, J.D. (2001): *An introduction to Igneous and Metamorphic Petrology*, Prentice Hall.
8. Wood, B.J. and Fraser, D.G. (1976): *Elementary Thermodynamics for Geologists*, Oxford University Press, London.
9. Yardley, B.W.D., Mackenzie, W.S. and Guilford, C. (1995): *Atlas of Metamorphic Rocks and their textures*, Longman Scientific and Technical, England.
10. Best, M.G., 1986: *Igneous Petrology*, CBS Publ.
11. McBirney, A.A., 1993: *Igneous Petrology*. Jones & Bartlet Publ.
12. Kretz, A., 1994: *Metamorphic Crystallization*, John Wiley.
13. Bose, M.K., 1997; *Igneous Petrology*. World Press.

Course Code: GEO 622

Course Title : Sedimentology

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: Fluid flow concept and sediment transport. Shape, size, and fabric of the sedimentary particles and surface textures. Formation and classification of sedimentary structures & bed-forms. Application of sedimentary structures in palaeocurrent analysis.

UNIT – 2: Clastic sedimentary rocks: Rudaceous, Arenaceous and Argillaceous. Classification & petrogenesis of sandstones, Graywacke and graywacke problem; Argillaceous rocks, their classification and genesis. Volcaniclastic sediment and their characteristics.

UNIT – 3: Non-clastic sedimentary rocks: Limestone, Dolomite and Evaporites. Study of evaporites such as gypsum, anhydrite and halite. Detailed study of siliceous, phosphatic and ferruginous rocks. Diagenesis - physical and chemical, processes and evidences of diagenesis in sandstones, mud rocks and carbonate rocks.

UNIT – 4: *Evolution of sedimentary basins:* tectonics and sedimentation. *Sedimentary environments and facies.* Continental, alluvial-fluvial, lacustrine, desert-aeolian and glacial sedimentary systems. Shallow coastal clastics. Marine and continental evaporites. Shallow water carbonates. Deep sea basins.

Books Recommended:

1. Allen, J.R.L., 1985: *Principles of Physical Sedimentation*, George Allen & Unwin.
2. Allen, P., 1997: *Earth Surface Processes*. Blackwell.
3. Nichols, G., 1999: *Sedimentology and Stratigraphy*. Blackwell.
4. Reading, H.G. 1996: *Sedimentary Environments*. Blackwell.
5. Davis, R.A. Jr., 1992: *Depositional Systems*. Prentice Hall.
6. Einsele, G., 1992: *Sedimentary Basins*. Springer Verlag.
7. Reineck, H.E. and Singh, I.B., 1980: *Depositional Sedimentary Environments*. Springer-Verlag.
8. Prothero, D.R. and Schwab, F., 1996: *Sedimentary Geology*. Freeman.
9. Miall, A.D., 2000: *Principles of Sedimentary Basin Analysis*. Springer-Verlag.
10. Pettijohn, F.J., Potter, P.E. and Siever, R., 1990: *Sand and Sandstone*. Springer Verlag
11. Blatt, H, Murray, G.V. and Middleton, R.C., 1980: *Origin of Sedimentary Rocks*.
12. Bhattacharya, A and Chakraborti, C., 2000: *Analyses of Sedimentary Successions*. Oxford-IBH.
13. Boggs Sam Jr., 1995: *Principles of Sedimentology and Stratigraphy*, Prentice Hall.
14. Sengupta, S., 1997: *Introduction to Sedimentology*, Oxford-IBH.

Course Code: GEO623**Course Title : Ore Geology**

| | | | |
|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: Modern concept of ore genesis: spatial and temporal distribution of ore deposits – a global perspective. Earth's evolutionary history and evolutionary trends in ore deposits. Ore deposits and plate tectonics. Mode of occurrence of ore bodies – morphology and relationship of host rock. Textures, paragenesis and zoning of ores and their significance. Concept of ore bearing fluids, their origin and migration; wall-rock alteration; structural, physico-chemical and stratigraphic control of ore localization.

UNIT – 2: Chemical composition of ores: bulk chemistry, trace elements, REE and, stable and radiogenic isotopes. Organic matter in ores and their significance. Mineralogy, genesis, use, and Indian distribution of ore minerals related to Fe, Mn, Cr, Cu, Pb, Zn, Al, Au, Sn, W and U.

UNIT – 3: Fluid inclusion in ores: principles, assumption, limitations and applications. Petrological ore associations with Indian examples wherever feasible: orthomagmatic ores of mafic-ultramafic association – diamonds in kimberlites, REE in carbonatites, Ti-V ores, chromite and PGE, Ni ores, Cyprus type Cu-Zn. Ores of silicic igneous rocks – Kiruna type Fe-P; pegmatoids, greisens, skarns, porphyry associations, Kuroko-type Zn-pb, Cu.

UNIT – 4: Ores of sedimentary affiliations: Chemical and clastic sedimentation, stratiform and stratabound ore deposits (Mn, Fe, non-ferrous ores), placers and palaeoplacers. Ores of metamorphic affiliations: metamorphism of ores, metamorphogenic ores. Ores related to weathering and weathered surface-laterite, bauxite, Ni/Au laterite.

Books Recommended:

1. Craig, J.M. & Vaughan, D.J., 1981: *Ore Petrography and Mineralogy*. John Wiley.
2. Evans, A.M., 1993: *Ore Geology and Industrial Minerals*. Blackwell.
3. Sawkins, F.J., 1984: *Metal deposits in relation to plate tectonics*. Springer Verlag.
4. Stanton, R.L., 1972: *Ore Petrology*, McGraw Hill.
5. Torling, D.H., 1981: *Economic Geology and Geotectonics*. Blackwell Sci Publ.
6. Barnes, H.L., 1979: *Geochemistry of Hydrothermal Ore Deposits*. John Wiley:
7. Klemm, D.O. and Schneider, H.J., 1977: *Time and Strata Bound Ore Deposits*. Springer Verlag.
8. Guilbert, J.M. and Park, Jr. C.F., 1986: *The Geology of Ore Deposits*. Freeman.
9. Mookherjee, A., 2000: *Ore genesis -a Holistic Approach*. Allied Publisher.
10. McKinstry, H.E., 1962: *Mining Geology*. II Ed. Asia Publishing House.
11. Clark, G.B., 1967: *Elements of Mining*. III Ed. John Wiley.
12. Arogyaswamy, R.P.N., 1996: *Courses in Mining Geology*. IV Ed. Oxford IBH.
13. Sinha, R.K and Sharma, N.I. *Mineral Economics*
14. Wolfe, J.A. *Mineral Resources: A world review*
15. Smirnov, V.I. *Geology of Ore Deposits*

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|-----------------|-------|-------|-------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

Course Code: GEO 624

Course Title : Principles of Stratigraphy and Indian Stratigraphy

UNIT – 1: Controls on the development of stratigraphic records. Lithostratigraphy – correlation and stratigraphic code. Biostratigraphy: controlling factors, zonation and time significance. Magnetostratigraphy, event stratigraphy, seismic stratigraphy, and sequence stratigraphy. Chronostratigraphic Units, Geologic time Units.

UNIT – 2: Precambrian of Rajasthan, Dharwar craton, Eastern Ghat belt and Singhbhum-Orissa belt; Proterozoic stratigraphy of Vindhyan, Cuddapah and Kurnool basins; Life in Precambrian.

UNIT – 3: Stratigraphy, facies, and fossil contents of the Palaeozoic Formations of the Himalayas. Classification, fauna, flora and age limits of Gondwana Supergroup and palaeoclimate.

UNIT – 4: Triassic of Spiti; Jurassic of Kutch; Cretaceous of Trichinopoly, Himalayan Palaeogene and Neogene Successions; Tertiary deposits of Assam and its equivalent in North East India.

Boundary problems in stratigraphy: Precambrian-Cambrian, Permian-Triassic, Cretaceous-Tertiary, Neogene-Quaternary with reference to India. Geological succession of Indo-Burma area (i.e. Northeast Indian states).

Books Recommended:

1. Pomeroy, C., 1982: *The Cenozoic Era: Tertiary and Quaternary*. Ellis Harwood Ltd.
2. Goodwin, A.M., 1991: *Precambrian Geology: The Dynamic Evolution of Continental Crust*. Academic Press.
3. Boggs, Sam Jr., 1995: *Principles of Sedimentology and Stratigraphy*, Prentice Hall
4. Doyle, P. and Bennett, M.R., 1996: *Unlocking the Stratigraphic Record*. John Wiley.
5. Brenner, R.E. and McHargue, T.R., 1988: *Integrative Stratigraphy: Concepts and Applications*. Prentice Hall.
6. Naqvi, S.M. and Rogers, J.J.W., 1987: *Precambrian Geology of India*, Oxford Univ. Press.
7. Pascoe, E.H., 1968. *A Manual of Geology of India and Burma*, Vol. I-IV, Govt. of India Press.
8. Krishnan, M.S. *Geology and India and Burma*
9. Kumar, R. *Fundamental of Historical Geology and Stratigraphy of India*
10. Wadia, D.N. *Geology of India*
11. GSI Miscellaneous Publication: *Indian Committee on Stratigraphic Nomenclature of India*.
12. Ramakrishnan, M and Vaidyanadhan, R (2008). *Geology of India*. GSI, Bangalore, Vol. 1&2.
13. Prothero, D.R. and Schwab, F (1996). *Sedimentary Geology: An introduction to sedimentary Rocks and Stratigraphy*. W.H. Freeman.
14. GSI (1990) Stratigraphic boundary problem in India. *Memoir*, 16.
15. Brookfield, M.E. (2004) *Principles of stratigraphy*. Blackwell.
16. Lele, K.M. (1976). Palaeoclimatic implications of Gondwana floras. *Geophytology* 6(2): 207-229.

PRACTICALS**Course Code: GEO 625****Course Title: Igneous and Metamorphic Petrology**

Megascopic and microscopic study of igneous rocks. Calculation of CIPW Norms. Preparation of variation diagrams. Megascopic and microscopic study of metamorphic rocks of different facies. Detailed study of textures in rock sections with reference to time relations between the phases of deformation and recrystallization of minerals. Calculation of ACF, AKF and AFM values from chemical and structural formulation of minerals and their graphical representation. Graphic presentation of various petrographic and petrochemical data.

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| Credit : 2 | L - 0 | P - 2 | T - 0 |
| Marks (CIA:ESE) | - | 10:40 | - |

Course Code: GEO 626**Course Title : Sedimentology**

Study of primary, secondary and biogenic sedimentary structures in hand-specimens, and field photographs. Tilt corrections of palaeocurrent analysis. Petrography of clastic and chemical sedimentary rocks. Microscopic study of heavy minerals. Exercises on mineralogical and geochemical data plots for environmental interpretations.

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| Credit : 2 | L - 0 | P - 2 | T - 0 |
| Marks (CIA:ESE) | - | 10:40 | - |

Course Code: GEO 627**Course Title: Ore Geology**

Megascopic study of structures and fabrics of different ores and their associations. Mineralogical and textural studies of common ore minerals under ore-microscope and petrological study of other industrial and non-metallic minerals. Exercises in the determination of reflectivity and micro hardness of common ore minerals.

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| Credit : 2 | L - 0 | P - 2 | T - 0 |
| Marks (CIA:ESE) | - | 10:40 | - |

Course Code: GEO628: Field Training

Course Code: GEO 631

Course Title : Engineering geology and Hydrogeology

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: Role of geology in major engineering projects and subsurface investigations. Basic fundamentals on soil and rock mechanics, engineering properties of soil and rocks. Physical characters of building stones. Metal and concrete aggregates.

UNIT – 2: Geological considerations for evaluation of dams and reservoir sites. Geotechnical evaluation of tunnel alignments, transportation routes and bridges. Mass movements with special emphasis on landslides and causes of hill slope instability. Influence of geological conditions on foundation and design of buildings.

UNIT – 3: Groundwater: exploration, importance, origin, occurrence, reservoirs and movements. Hydrologic properties of rocks: porosity, permeability, specific yield, specific retention, hydraulic conductivity, transmissivity and storage coefficient. Aquifers and their types. Darcy's law; its range and validity. Water table contour maps.

UNIT – 4: Ground water quality for different uses. Water contamination and pollution. Ground water level fluctuations. Pumping test analysis. Artificial recharge of ground water. Consumptive and conjunctive of surface and groundwater. Groundwater-river interaction. Salt water intrusion in coastal aquifers and remedial measures.

Books Recommended

1. Bell, F.G., 1992: *Fundamentals of Engineering Geology*. Aditya Books Pvt. Ltd. Indian Edition
2. Jaeger & Cook: *Fundamentals of Rocks Mechanics*.
3. Punmia, *Soil Mechanics and Foundation*
4. Krynine, D.H. and Judd, W.R., 1998: *Principles of Engineering Geology*. CBS Edition
5. Todd, O.K., 1980: *Groundwater Hydrology*. John Wiley.
6. Davies, S.N. & De Wiest, A.J.M., 1966: *Hydrogeology*. John Wiley.
7. Freeze, A.A. & Cherry, J.A., 1979: *Ground Water*. Prentice Hall.
8. Fetter, C. W., 1990: *Applied Hydrogeology*, Merrill Publishing.
9. Raghunath, N.M., 1982: *Ground Water*. Wiley Eastern.
10. Karanth, K.R., 1987: *Groundwater Assessment-Development and Management*. Tata McGraw Hill.

Course Code: GEO 632

Course Title: Resource Geology

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: Coal:definition and origin of kerogen and coal. Rank, grade and type of coal.Classification of coal. Chemical characterization: proximate and ultimate analyses. Petrography of coalcoal petrology, concept of lithotypes, macerals and micro-lithotypes and their classification.Preparation of coal for industrial purposes.

UNIT – 2: Maturation of coal and generation of methane in coal beds. Geological and geographical distribution of coal deposits in India. Detailed geology for some important coalfields of India. Methods of coal prospecting and estimation of coal reserves. Underground coal gasification: definition, concept, development and environmental benefits.

UNIT – 3: Petroleum: its composition and different fractions. Origin, nature and migration of oil and gas.Transformation of organic matter into kerogen, organic maturation and thermal cracking of kerogen.Characteristics of Reservoir rocks and oil traps.Prospecting for oil and gas, drilling and logging procedures.Major oil bearing basins of the Indian subcontinent.Position of oil and natural gas in India and future prospects.

UNIT – 4:Atomic Energy:mode of occurrence and association of atomic minerals in nature. Atomic minerals as source of energy.Methods of prospecting and productive geological horizons in India.

Books Recommended:

1. Taylor, G.H., Teichmuller, M., Davis, A., Diessel, C.F.K., Littke, R. and Robert, P, 1998: *Organic Petrology*. Gebruder Borntraeger, Stuttgart.
2. Chandra, D., Singh, R.M. and Singh, M.P., 2000: *Textbook of Coal* (Indian Context). Tara Book Agency, Varanasi.
3. Singh, M.P. (Ed.), 1998: *Coal and Organic Petrology*. Hindustan Publ. Corp., New Delhi.
4. Stach, E., Mackowsky, M.T.H., Taylor G.H., Chandra, D., Teichmuller, M., and Teichmuller, R., 1982 :*Stach's Text Book of Coal Petrology*, Gebruder Borntraeger, Stuttgart.
5. Holson, G.D. and Tiratsoo, E.N., 1985: *Introduction to Petroleum Geology*. Gulf Publ. Houston, Texas.
6. Tissot, B.P. and Welte, D.H., 1984: *Petroleum Formation and Occurrence*. Springer- Verlag.
7. Selley, R.C., 1998: *Elements of Petroleum Geology*. Academic Press.
8. Durrance, E.M., 1986: *Radioactivity in Geology. Principles and Application*. Ellis Hoorwool
9. Dahlkamp, F.J., 1993: *Uranium Ore Deposits*. Springer'Verlag.
10. Boyle, R.W., 1982: *Geochemical Prospecting for Thorium and Uranium Deposits*. Elsevier.

Course Code: GEO 633

Course Title : Geomorphology and Remote sensing

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: Historical Development in geomorphology; Geomorphological Studies: dynamics of geomorphology, fluvial landforms, Drainage Patterns, drainage Anomaly and Morphometric analysis. evolution of landforms in Aeolian, glacial and karst landscape.

UNIT – 2: An elementary idea about morphochronology; Morphotectonics, Neotectonics – geomorphologic Thresholds, Active Tectonics, Paleoseismicity. Brief outline of Geomorphology of India; Application of geomorphology in mineral prospecting, civil engineering, military purposes, hydrogeology and environmental studies.

UNIT – 3: Principles of remote sensing: general idea about electromagnetic spectrum, aerial photographs and their geometry, photogrammetry: recent advancements and applications. Satellite remote sensing.

UNIT – 4: Global and Indian space missions. Different satellite exploration programs and their characteristics: LANDSAT, METEOSAT, MODIS, SPOT, IRS. Image interpretation and digital processing techniques.

Books Recommended:

1. Miller, V.C., 1961: *Photogeology*. McGraw Hill
2. Sabbins, F.F., 1985: *Remote Sensing -Principles and Applications*. Freeman. ,
3. Ray. R.G., 1969: *Aerial Photographs in Geologic Interpretations*. USGS Prof. Paper 373.
4. Drury, S.A., 1987: *Image Interpretation in Geology*. Allen and Unwin.
5. Moffitt, F. H. and Mikhail, E.M.,1980: *Photogrammetry*, Harper and Row.
6. Lillesand, T.M. and Kieffer, R.W., 1987: *Remote Sensing and Image Interpretation*. John Wiley.
7. Paine, D.P., 1981: *Aerial photography and Image Interpretation for Resource Management*. John Wiley.
8. Pandey, S.N., 1987: *Principles and Applications of Photogeology*. Wiley Eastern, New Delhi.
9. Gupta, R.P., 1990: *Remote Sensing Geology*. Springer Verlag.

Course Code: GEO 634

Course Title : Mineral Exploration and Mining geology

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: Concepts of exploration. Criteria and guides to prospecting. Geological exploration methods of regional and detailed geological mapping, pitting, trenching, drilling and sampling methods.

UNIT – 2: Geophysical exploration: concepts and geophysics, principles of gravity, magnetic, electrical, seismic and radioactive methods of prospecting. Introduction to airborne geophysical survey.

UNIT – 3: Geochemical methods: geochemistry in mineral exploration, types of geochemical survey and tools, path finders, geochemical mobility of elements and dispersion haloes. Geobotanical methods: plants as indicators of mineralization, biogeochemical methods.

UNIT – 4: Classification of mining methods. Planning, exploration and exploratory mining of surface and underground mineral deposits involving diamond drilling, shaft sinking, drifting, cross-cutting, winzining, stoping, room and pillaring, top-slicing, sub-level caving and block caving. Types of drilling methods. Mining hazards: mine inundation, fire and rock burst.

Books Recommended:

1. Sharma, P.V., 1986: *Geophysical Methods in Geology*. Elsevier.
2. McKinstry, H.E., 1962: *Mining Geology*, II Ed, Asia Publishing House.
3. Clark, G.B., 1967: *Elements of Mining*. III Ed. John Wiley.
4. Arogyaswamy, R.P.N., 1996: *Courses in Mining Geology*. IV Ed. Oxford IBH.
5. Evans, A.M. 1995: *Introduction to Mineral Exploration*. Blackwell Science
6. Vogelsang, D., 1995: *Environmental Geophysics -A Practical Guide*. Springer Verlag.
7. Dobrin, M.B., 1976: *Introduction to Geophysical Prospecting*. McGraw Hill.
8. Stanislave, M., 1984: *Introduction to Applied Geophysics*, Reidel Publ.
9. Kreiter – *Geological Prospecting and Exploration*
10. Mckinstry, H.E. 1962: *Mining Geology* (2nded). Asia Publishing House.
11. Ginzburg– *Principles of Geochemical Prospecting*
12. Pacal, Z. (ed), 1977: *Geochemical Prospecting Methods*. Ustrendi
13. Brooks, A.R., 1972: *Geobotany and Biogeochemistry in Mineral Exploration*. Harper & Row.
14. Rose, A.W., Hawkes, H.E. and Webb, J.A., 1979: *Geochemistry in Mineral Exploration*. Academic Press.
15. Bell, F.G., 1992: *Fundamentals of Engineering Geology*. Aditya Books Pvt. Ltd. Indian Edition.

PRACTICALS**Course Code: GEO 635****Course Title: Engineering and Hydrogeology**

Study of properties of common rocks with reference to their utility in engineering projects. Study of maps and models of important engineering structures as dam sites and tunnels. Interpretation of geological maps for landslide problems. Various problems of soil and rock mechanical properties. Study of seismic and flood-prone areas in India. Analyses for alkalinity, acidity, pH and conductivity (electrical) in water samples. Classification of ground water for use in drinking, irrigation and Industrial purposes. Presentation of chemical analyses data and plotting chemical classification diagram. Evaluation of environmental impact of air pollution groundwater, landslides, deforestation, cultivation and building construction in specified areas.

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| Credit : 2 | L - 0 | P - 2 | T - 0 |
| Marks (CIA:ESE) | - | 10:40 | - |

Course Code: GEO 636**Course Title: Resource Geology**

Megascope characterization of banded coals. Proximate analysis of coal. Completion of outcrops in the given maps and calculation of coal reserves.

Preparation of polished particulate mounts of coal.

Microscopic examination of polished coal pellets (identification of macerals in coal). Megascope and microscopic study of cores and well cuttings. Study of geological maps and sections of important oilfields of India and world. Calculation of oil reserves.

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| Credit : 2 | L - 0 | P - 2 | T - 0 |
| Marks (CIA:ESE) | - | 10:40 | - |

Course Code: GEO 637**Course Title: Geomorphology and Remote Sensing:**

Study of nature of aerial photographs: resolution, mosaics, symbols, gully pattern and drainage analysis, image parallax. Determination of scale, height, dip, slope, vertical exaggeration and image distortion. Making false color composites, and study of multi-spectral scans and spectral patterns. Exercises on digital image processing. Study of environmental hazard maps.

Drainage and slope morphometry, hypsometry; Geomorphology through topo-sheets, aerial photos and satellite imagery; Terrain aspect mapping.

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| Credit : 2 | L - 0 | P - 2 | T - 0 |
| Marks (CIA:ESE) | - | 10:40 | - |

Course Code: GEO 638**Course Title: Mineral Exploration and Mining Geology**

Study of gravimeter, magnetometer and seismographs. Resistivity survey. Interpretation of underground structure on the basis of seismic data. Study of prospecting procedures of some important deposits. Study and interpretation of geological maps/mine plans and sections of mineral deposits. Calculation of assay values, ore and mineral reserves from maps and data.

Study of geochemical and geophysical anomalies, and their interpretation. Planning, exploration and exploratory mining of surface and underground mineral deposits involving diamond drilling, shaft sinking, drifting, cross cutting, winzings, stoping, room and pillaring, top-slicing, sub-level caving and block caving. Cycles of surface and underground mining operations.

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| Credit : 2 | L - 0 | P - 2 | T - 0 |
| Marks (CIA:ESE) | - | 10:40 | - |

SEMESTER IV**THEORY****Course Code: GEO 641****Course Title: Environmental Geology**

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|------------------------|--------------|--------------|--------------|
| Credit : 4 | L - 4 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 30:70 | - | - |

UNIT – 1: Time scales of global changes in the ecosystems and climate. Impact of circulations in atmosphere and oceans on climate. Carbon dioxide in atmosphere, limestone deposits in the geological sequences, records of palaeo-temperatures in ice cores of glaciers.

UNIT – 2: Global warming caused by CO₂ increase in present atmosphere due to indiscrete exploitation of fossil fuels, volcanic eruptions and deforestation. Cenozoic climate, extreme evolution of life, especially the impact on human evolution.

UNIT – 3: Impact assessment of degradation and contamination of surface water and ground water quality due to industrialization and urbanization. Water logging problems due to the indiscrete construction of canals, reservoirs and dams. Soil profiles and soil quality degradation due to irrigation, use of fertilizers and pesticides.

UNIT – 4: Influence of neotectonics in seismic hazards assessment, preparation of seismic hazard maps. Seismic zones of India. Distribution, magnitude and intensity of earthquakes. Introduction to Environmental Impact Assessment Analysis. Concept and steps of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP).

Books Recommended:

Valdiya, K.S., 1987: *Environmental Geology -Indian Context*. Tata McGraw Hill

Keller, E.A., 1978: *Environmental Geology*, Bell and Howell, USA

Bryant, E., 1985: *Natural Hazards*, Cambridge University Press.

Patwardhan, A.M., 1999: *The Dynamic Earth System*. Prentice Hall

Subramaniam, V., 2001: *Textbook in Environmental Science*, Narosa International.

Bell, F.G., 1999: *Geological Hazards*. Routledge, London.

Smith, K., 1992: *Environmental Hazards*. Routledge, London.

Students will require to choose any one of the subject offered as Special Paper during the semester.

Course Code: GEO 642: Special Paper

A list of special papers will be given, out of which students can choose any one. However, this may be subject to availability of faculty members.

Course Code: GEO 643: Dissertation

Students of M. Sc. Final year will undertake a short programme of research in the form of dissertation. The short research programme can address either economic or academic problems and may be in the form of:

- Laboratory study
- Experimental investigation
- Field study/investigation
- Theoretical investigation accompanied by computational work, data processing and analysis, or
- Combination of these.

The results of the research programme will be presented in a dissertation which will be evaluated by a board of examiners.

National Cadet Corps

Course Rationale: The introduction of NCC as an Elective extension course at the Degree level is aimed at equipping the youths to become better and responsible citizens of the country. The course focuses on citizenship, patriotism, environment, health and hygiene, leadership and personality development skills apart from specialised studies on Army and Air Force. The overall aim of the course is to prepare the young cadets to face all challenges of life and take their place as leaders in any career or walk of life that they choose.

Semester I

Course Code: NCC (ARW/AMW) 111
Course Title: National Cadet Corps I

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|-----------------|-------|-------|-------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 20:30 | - | - |

Unit I: NCC Organization: Aims and Objectives of NCC, Organization, Training, Incentives, Certificate Examinations, and NCC Song; Duties, Responsibilities and Conduct by NCC Cadets, Organization of Defence Forces in India, Ranks in Army, Navy and Air Force.

Unit II: National Integration and Awareness: Introduction to Constitution of India, National Integration: Importance and necessity, Factors affecting National Integration, Unity in Diversity, Role of NCC in Nation building, NCC and National Integration.

Unit III: Health and Hygiene: Introduction, Hygiene and Sanitation, Physical and Mental Health; First Aid: Principles and motto, first aid in common medical emergencies – Fractures, Wounds, Drowning, Artificial respiration.

Semester II

Course Code: NCC (ARW/AMW) 121
Course Title: National Cadet Corps II

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|-----------------|-------|-------|-------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 20:30 | - | - |

Unit I: Foot Drills Basics: Aims and Objectives of Drills, Drill Commands and its Importance, General Words of commands in a drill, Types of Marching, Types of pace; Turning and Wheeling, Saluting on the march, Timing in a march, changing step, formation of squad and squad drill.

Unit II: Leadership and Personality Development: Leadership traits; Indicators of Good Leadership, Personality development, factors influencing personality development, Interpersonal relationship and communication skills.

Unit III: Environmental Awareness: Ecology and environment, biodiversity, environment conservation, waste management, water conservation and harvesting, Types of pollution and its control.

Semester III

Course Code: NCC (ARW) 231
Course Title: National Cadet Corps III

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|------------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 20:30 | - | - |

Unit I: Air Force Orientation: History of IAF, Organization of Indian Air Force, Branches of IAF, Career in Indian Air Force.

Unit II: Air Craft Recognition: Fighters, Transports, Helicopters, Modern Trends.

Unit III: Principles of Flight: Introduction, Laws of Motion, Bernoulli's Theorem and Venturi Effect, Principles of flights- Glossary of terms, Aerofoil, Forces on Aircraft – Lift and Drag, Flap and Slats, Stalling and Thrust.

Semester III

Course Code: NCC (AMW) 231
Course Title: National Cadet Corps III

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|------------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 20:30 | - | - |

Unit I: Armed Forces: Basic Organization of Armed Forces, Organization of Army, Badges and Ranks, Task and Role of Supporting Arms and Services, Modes of Entry, Honours and Awards

Unit II: Map Reading I: Introduction to maps and conventional signs, Scale and Grid systems, Topographical forms and technical terms, Relief, Contours and gradients, Cardinal points and types of north.

Unit III: Map Reading II: Types of bearing and use of service protector, Prismatic compass and its use and GPS, Setting of map, finding north and own position, map to ground, ground to map, point to point march..

Semester IV

Course Code: NCC (ARW) 241
Course Title: National Cadet Corps IV

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|------------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 20:30 | - | - |

Unit I: Airmanship: Introduction, Importance of Airmanship, Basic terminologies, Airfield Layout, Rules of the Air- Visual Flight Rules, Instrument Flight Rules, Right of Way, ATC and RT procedure.

Unit II: Navigation: Introduction, Requirements of Navigation, Glossary of terms, Maps and symbols, map reading procedure and reading aids.

Unit III: Meteorology: Importance of Meteorology and its application in Aviation, Clouds and Precipitation, Visibility: Importance, types and causes of poor visibility.

Semester IV

Course Code: NCC (AMW) 241
Course Title: National Cadet Corps IV

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|------------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 20:30 | - | - |

Unit I: Field Craft and Battle Craft I: Introduction, Judging Distance, Description of ground, recognition, description, indication of land mark and target.

Unit II: Field Craft and Battle Craft II: Observation, Camouflage and Concealment, Field Signals, Section Formations, Fire control orders, fire and movement, knots and lashings.

Unit III: Introduction to infantry weapons and equipment: Characteristics of 5.56 INSAS rifle, Ammunition, Firepower, Stripping, Assembling and Cleaning, Organization of Infantry Battalion, Characteristics of Company Support Weapons and Infantry Battalion Support Weapons.

Semester V

Course Code: NCC (ARW) 351
Course Title: National Cadet Corps V

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|------------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 20:30 | - | - |

Unit I: Aero Engines: Introduction, Components of Aero Engines, Principles of propulsion and types of engines, Piston engines, jet engines and turbo-prop engines.

Unit II: Air Frame: Basic Aircraft Controls, fuselage, main plane and tail plane, Ailerons, elevators and rudders, landing gears.

Unit III: Aero-modelling: History of Aero-modelling, materials used in aero-modelling, types of aero-modelling, safety code.

Semester V

Course Code: NCC (AMW) 351
Course Title: National Cadet Corps V

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|------------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 20:30 | - | - |

Unit I: Military History: Biographies of renowned Generals, Indian Army War Heroes (PVC), Indo-Pak Wars of 1965, 1971 and Kargil war.

Unit II: Communication I: Types of Communication, Characteristics of Wireless Technology, Characteristics of Walkie Talkie.

Unit III: Communication II: Basic Radio telephony (RT) Procedure, Latest trends and developments in communication .

Semester VI

Course Code: NCC (ARW/AMW) 361
Course Title: Introduction to SSB

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|------------------------|--------------|--------------|--------------|
| Credit : 2 | L - 2 | P - 0 | T - 0 |
| Marks (CIA:ESE) | 20:30 | - | - |

Unit I: Introduction and Screening Test: Introduction to SSB Interview, Qualities observed in a candidate, Personal Information Questionnaire, Intelligence Test (Verbal and Non-verbal), Picture Perception and Discussion Test (PP&DT).

Unit II: Psychological and Group Test Series: Basis of Psychological Testing, Thematic Apperception Test, Word Association Test, Situation Reaction Test, Self Description, Basis of Group Test, Group Discussion, Lecturette.

Unit III: Interview Technique and Conference Procedure: Basis of Interview Technique and Interview Questions, Conference Procedure.

Reference and Basic Readings:

1. NCC Cadet Training Handbook (Common Subjects)
2. NCC Cadet Training Hand Book Specialised Subject (Army Wing)
3. NCC Cadet Training Hand Book Specialised Subject (Air Wing)
4. Arihant's SSB Interview: The Complete Guide